WATER WORKS & SEWERAGE

A GILLETTE ABP ABC PUBLICATION

EDITOR

DECEMBER, 1937
VOLUME 84, No. 12

Again

PITTSBURGH METERS *are chosen!*

P.W.A. HOUSING PROJECT

Williamsburg

BROOKLYN, N. Y.

Some 5,000 persons will occupy the 1,622 apartments in the new PWA Housing Project in Williamsburg, Brooklyn, New York. The Williamsburg Houses cover twenty-four acres or twelve city blocks. It is the country's largest low-rent and slum-clearance project.

The water supply for this good-sized "town within a city", like that of thousands of other towns and cities both large and small, is measured by Pittsburgh Water Meters. They can be relied upon to give accurate measurement and long service.

PITTSBURGH EQUITABLE METER CO.
MERCO NORDSTROM VALVE CO.
MAIN OFFICES PITTSBURGH, PA.
ATLANTA BUFFALO CHICAGO MEMPHIS
NEW YORK COLUMBIA KANSAS CITY PHILADELPHIA TULSA HOUSTON LOS ANGELES OAKLAND

PITTSBURGH WATER METERS

Lithographed on stone by James E. Allen for U. S. Pipe & Foundry Co. Copyright 1937, U. S. Pipe & Foundry Co.

AS ANOTHER LENGTH of pipe is put in place, a railroad train roars by. A hundred years hence the completed conduit will still be serving but rail transportation may be a memory. Few things in this changing world are so nearly permanent as a cast iron pipe line. It is difficult to improve a material, such as cast iron pipe, whose attributes of long life, reliability and economy are matters of historical record. Nevertheless, our plants and laboratories have made significant gains in metallurgical and manufacturing methods which are reflected in both our pit cast and Super-de Lavaud centrifugally-cast pipe.

U.S. cast iron PIPE

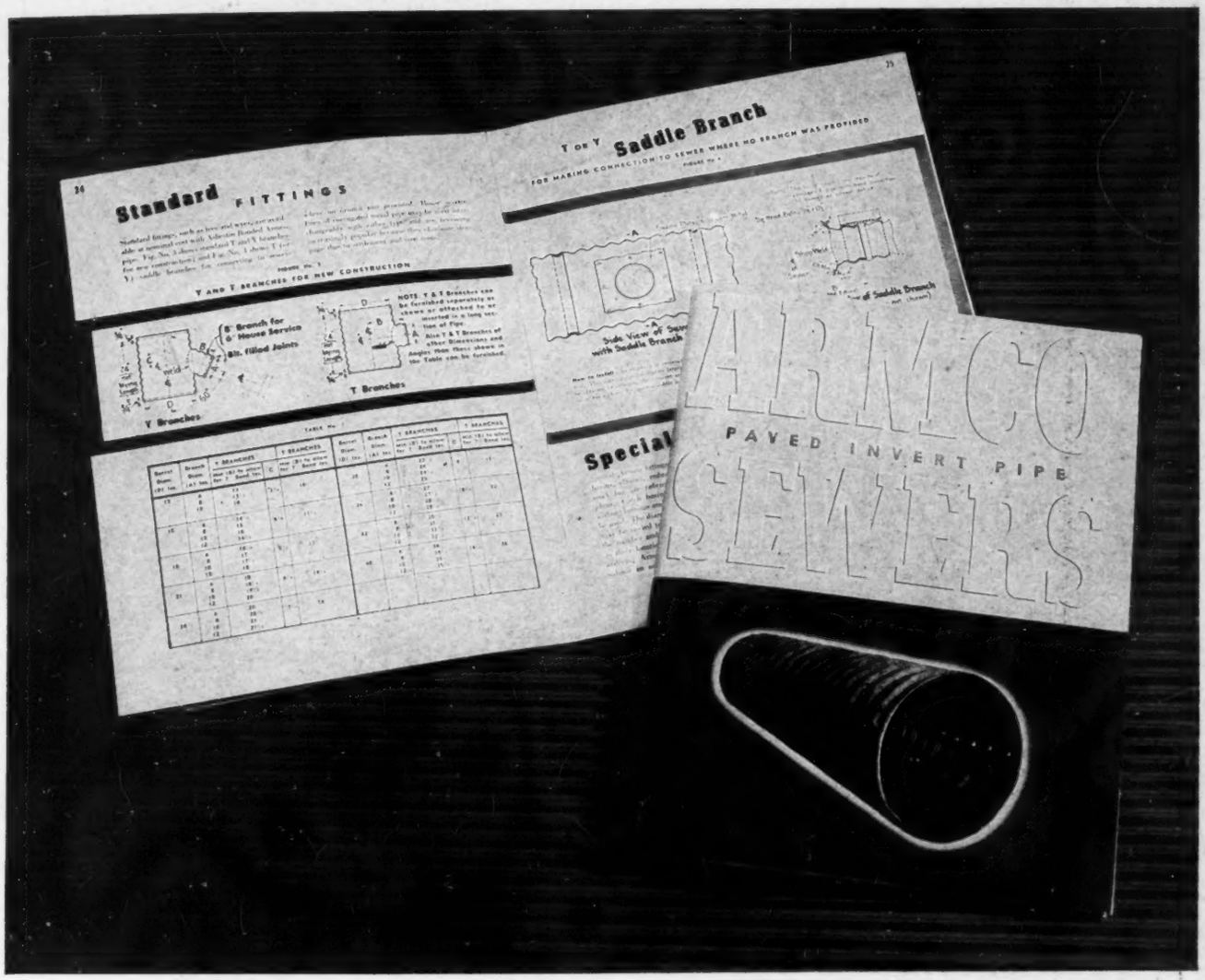
Cast iron and alloy cast iron pipe centrifugally or pit cast—for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. PIPE & FOUNDRY CO.

BURLINGTON, NEW JERSEY

Foundries and Sales Offices throughout the U. S.

FREE TO MUNICIPAL ENGINEERS AND CITY OFFICIALS



A NEW SEWER HANDBOOK FULL OF USEFUL INFORMATION

• Here at last is a complete, authoritative handbook telling you everything you want to know about Armco's improved sewer pipe.

Forty-eight pages of practical information including: Service records, installation pictures, useful tables and charts. You'll find complete data for estimating sewer sizes and comparative costs . . . accurate figures for designing water tight joints and fittings . . . besides a detailed municipal specification for *Asbestos Bonded* Armco Sewer Pipe.

To get your free copy of this valuable new handbook, simply fill in the convenient coupon below and mail it to: Armco Culvert Mfrs. Association, 703 Curtis Street, Middletown, Ohio. There's no obligation, of course.

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Send my copy of the new Armco Sewer Handbook.

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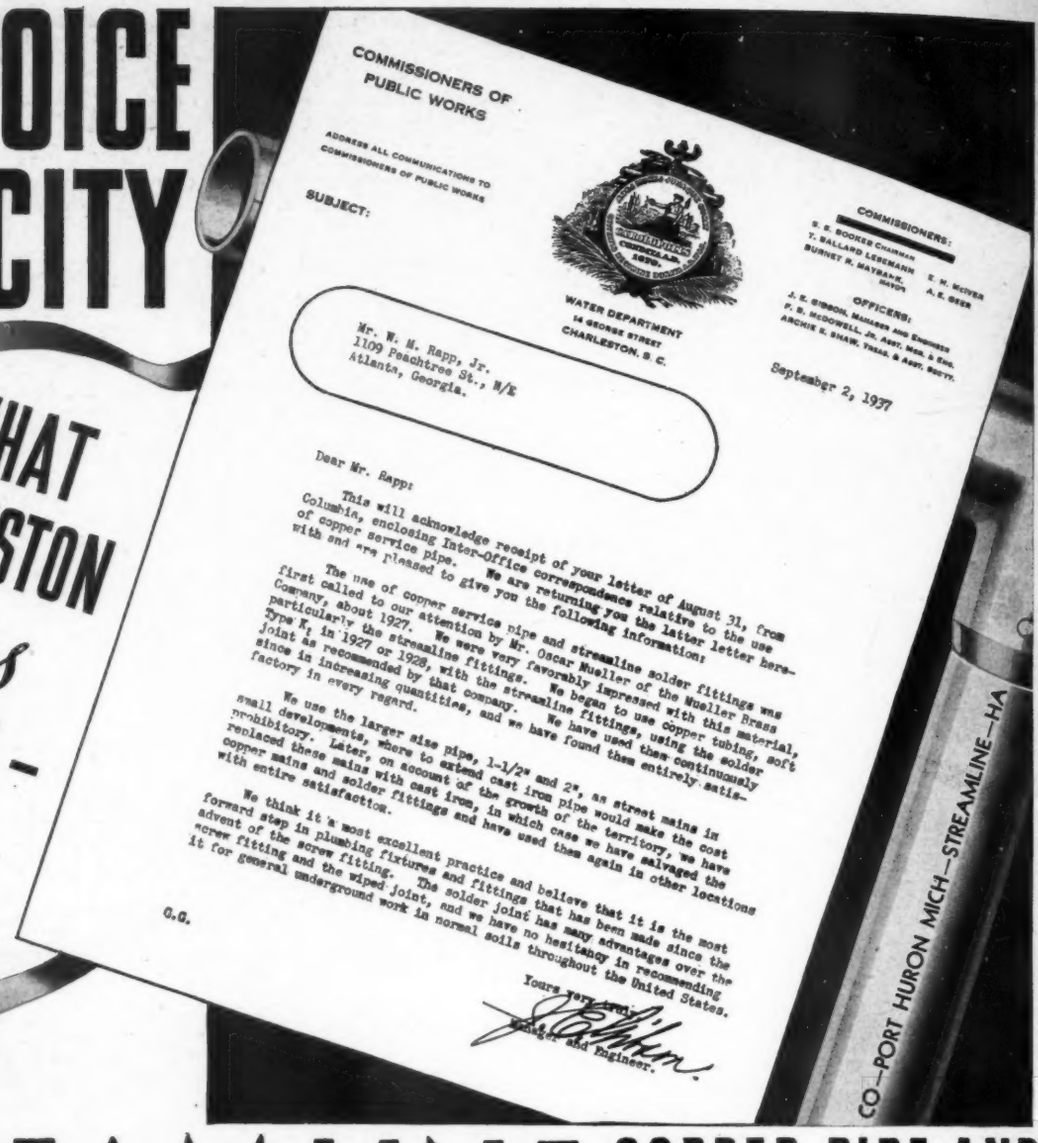
WWS-12-37

WATER WORKS AND SEWERAGE, December, 1937, Volume 84, Number 12. Published monthly at 400 West Madison Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, $2.00 per year; Canadian and Foreign, $3.00 per year. Copyright, 1937. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

THE VOICE OF A CITY

—WHAT CHARLESTON *Says* ABOUT—



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SUBJECT:

WATER DEPARTMENT
14 GEORGE STREET
CHARLESTON, S. C.

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Mr. W. M. Rapp, Jr.
1109 Peachtree St., N/E
Atlanta, Georgia.

September 2, 1937

Dear Mr. Rapp:

This will acknowledge receipt of your letter of August 31, from Columbia, enclosing Inter-Office correspondence relative to the use of copper service pipe. We are returning you the latter letter herewith and are pleased to give you the following information:

The use of copper service pipe and streamline solder fittings was first called to our attention by Mr. Oscar Mueller of the Mueller Brass Company, about 1927. We were very favorably impressed with this material, particularly the streamline fittings. We began to use copper tubing, soft Type K, in 1927 or 1928, with the streamline fittings, using the solder joint as recommended by that company. We have used them continuously since in increasing quantities, and we have found them entirely satisfactory in every regard.

We use the larger size pipe, 1-1/2" and 2", as street mains in small developments, where to extend cast iron pipe would make the cost prohibitory. Later, on account of the growth of the territory, we have replaced these mains with cast iron, in which case we have salvaged the copper mains and solder fittings and have used them again in other locations with entire satisfaction.

We think it a most excellent practice and believe that it is the most forward step in plumbing fixtures and fittings that has been made since the advent of the screw fitting. The solder joint has many advantages over the screw fitting and the wiped joint, and we have no hesitancy in recommending it for general underground work in normal soils throughout the United States.

C.G.

Yours very truly,

Manager and Engineer.

CO—PORT HURON MICH—STREAMLINE—HA

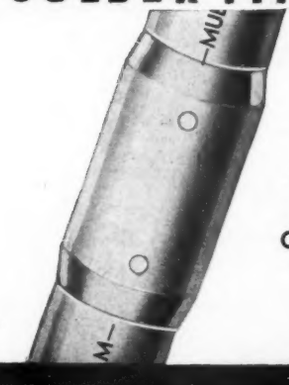
STREAMLINE COPPER PIPE AND SOLDER FITTINGS

TRADE MARK REG. U. S. PAT. OFFICE

● Mr. J. E. Gibson, Manager and Engineer, Water Department, Charleston, S. C., says "We began to use copper tubing, soft Type K, in 1927 or 1928, with the STREAMLINE Fittings, using the solder joint as recommended by that company. We have used them continuously since in increasing quantities, and we have found them entirely satisfactory in every regard"—and in addition Mr. Gibson says of the solder joint for underground use, "and we have no hesitancy in recommending it for general underground work in normal soils throughout the United States". COULD THERE BE A STRONGER RECOMMENDATION THAN THIS?

Years of service for underground work, under normal conditions of soil and water, have proved beyond doubt that STREAMLINE Copper Pipe and STREAMLINE Solder Fittings are the most modern and efficient materials on the market today for this class of work.

A STREAMLINE service line is vibration-proof—settlement of filled earth or water mains does not effect it. It is rust and clog-proof, and its joints are permanently tight. STREAMLINE is the ideal material for many applications in filtration plants; in aeration lines and in heating coils using the sludge digestion system in sewage disposal plants. When your plans call for a permanent piping installation—for any purpose, CONSIDER STREAMLINE CAREFULLY BEFORE YOU BUY.



Send for completely illustrated Catalog W-3.

STREAMLINE
PIPE AND FITTINGS DIVISION
MUELLER BRASS CO.
PORT HURON, MICHIGAN

TO ALL OF OUR MANY FRIENDS IN THE WATER FIELD

Greetings . . .

AS another year is approaching to its close, we soon will hear again the beautiful age-old message of "Peace on Earth, Good Will Toward Men." In the world of today, we can all earnestly hope that such sentiments will remain in the hearts and minds of all peoples.

May we express to you our grateful thanks for your kindly consideration and co-operation in our efforts to be of service; also for the many friendships that we are privileged to enjoy amongst you.

That your troubles be small, and your blessings large, is our heartfelt desire, in wishing you a Happy Christmas tide and a New Year filled with good health and prosperity.

Sales Manager.

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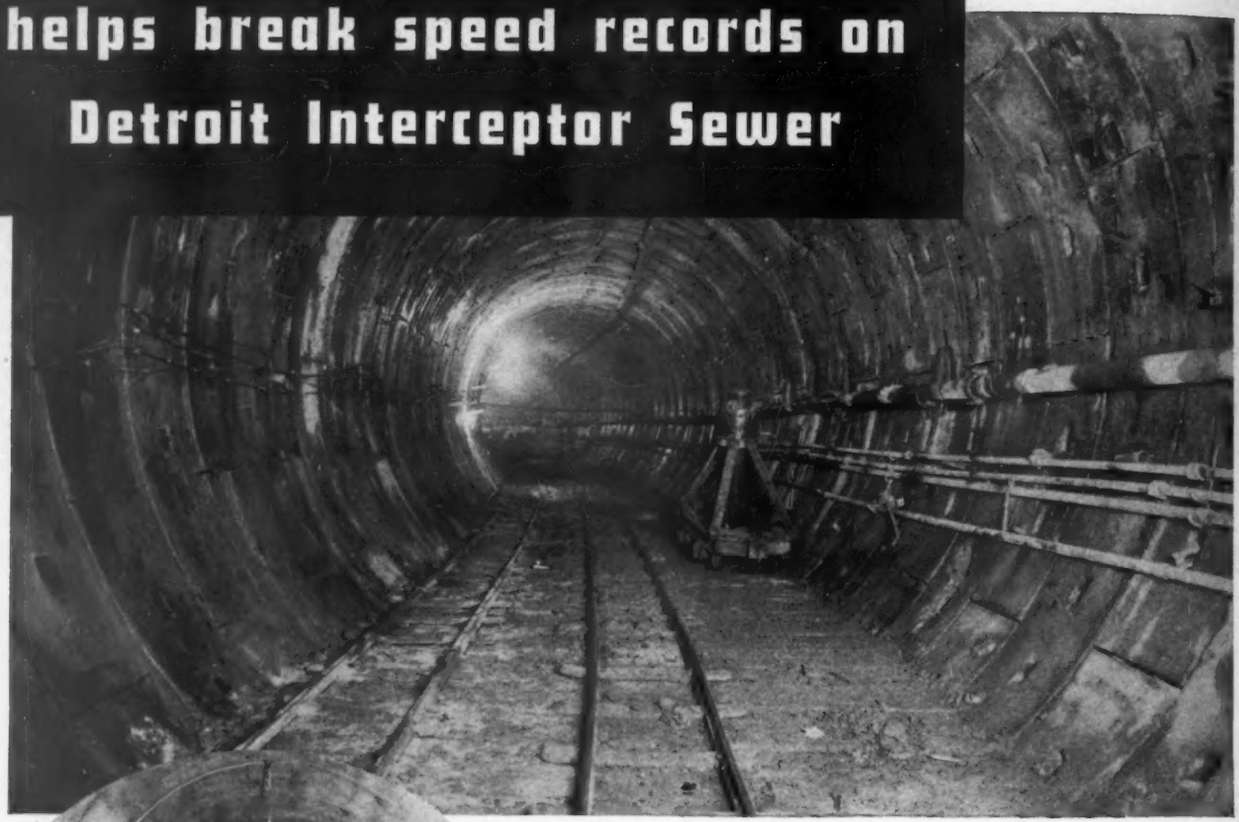
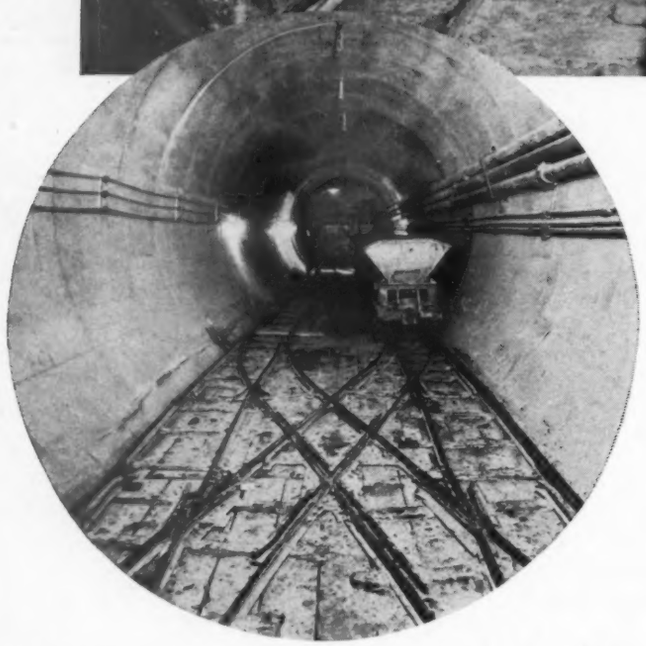
CONCRETE PRIMARY LINING

helps break speed records on Detroit Interceptor Sewer





16-in. concrete walls in place, Sec. 12, Detroit Interceptor. This job notable for true alignment, smooth finish and uniformly high quality concrete. Using 5 to 6½ gal. per cu. yd., strengths in excess of 7,000 lb. per sq. in. were frequently developed, as shown by test cores. Built by the city of Detroit as a PWA project under L. G. Lenhardt, commissioner of public works. Leo V. Garrity, in charge of construction. S. A. Healy Co., Chicago, contractor. Harvey Kruse, general superintendent.

PUSHING on toward completion is a $23,000,000 sewerage and sewage disposal program for the city of Detroit involving many miles of large diameter sewers built in tunnel.

Latest contract completed is Section 12 of the Detroit Interceptor Sewer. At the contractor's option the primary lining was made with precast, interlocking concrete blocks —a very fast method suitable for the stiff clay encountered. On this 5,992-ft. job the contractor averaged over 50 ft. of 16-ft. diameter tunnel per day of 20 hours, with a maximum of 90 ft.

Here as in many other sewerage programs, large and small, construction is 100% concrete. Concrete is not merely ideal for sewers; it is *unique*. It meets any design requirements. It lends itself to efficient construction. Its moderate first cost, long life, and low maintenance help make the sewer investment safe and profitable.

PORTLAND CEMENT ASSOCIATION

Dept. 12-29, 33 W. Grand Ave., Chicago, Ill.

A National Organization to Improve and Extend the Uses of Concrete

WHEN MILLIONS ARE AT STAKE SEWERS ARE BUILT OF CONCRETE

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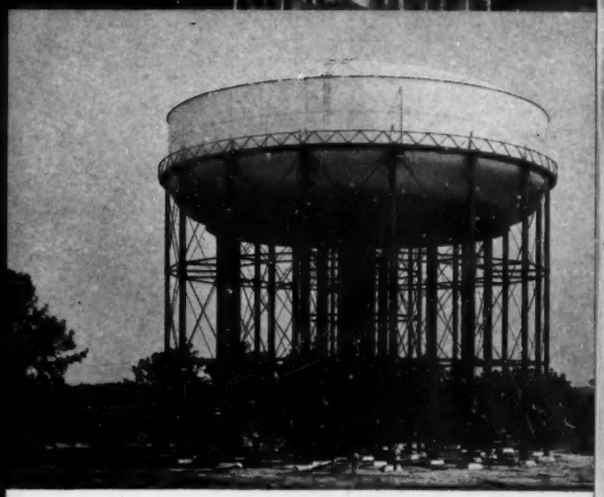
Means...

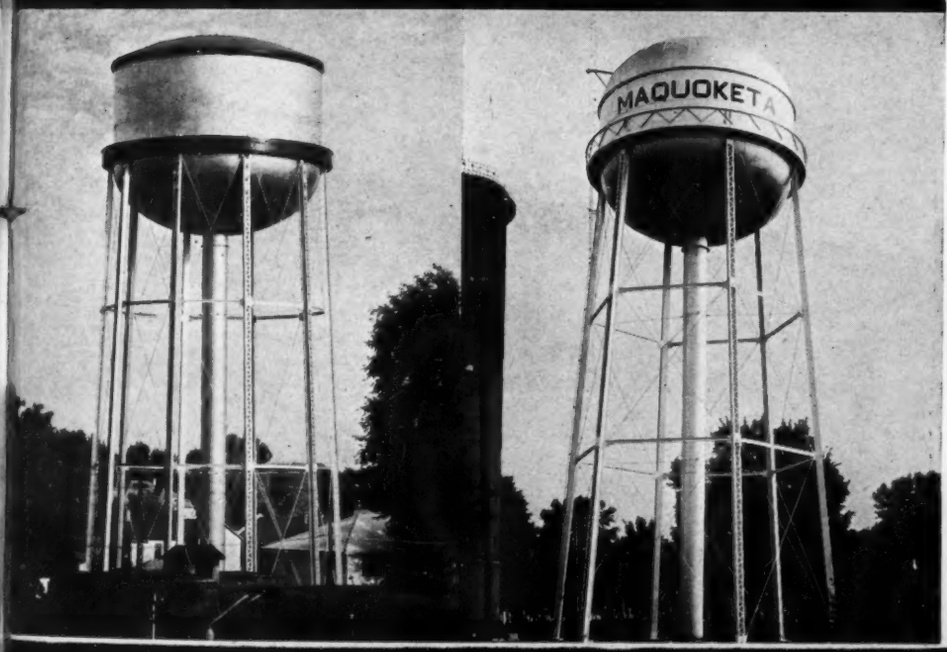
PROVED

DEPENDABLE

MATERIAL

Properly Designed and Manufactured





. . . This has been true for over forty years. • In the building of Elevated Steel Tanks—as in all its manufacturing activities, Pittsburgh-Des Moines achieves the ideal of *Quality . . . at Lowest Cost*. Quality in intelligent design . . . quality in materials, full weight and honestly fabricated . . . quality in workmanship and erection —*at lowest cost to you* by means of modern efficiency in manufacture and the plain "know-how" of experience. • Are Elevated Steel Tanks a present concern of yours? P·DM maintains a complete engineering advisory service at the disposal of any interested authority, without obligation. For a consultation, write to our nearest office—and ask for your copy of P·DM's latest 20-page "Modern Water Storage" Bulletin!

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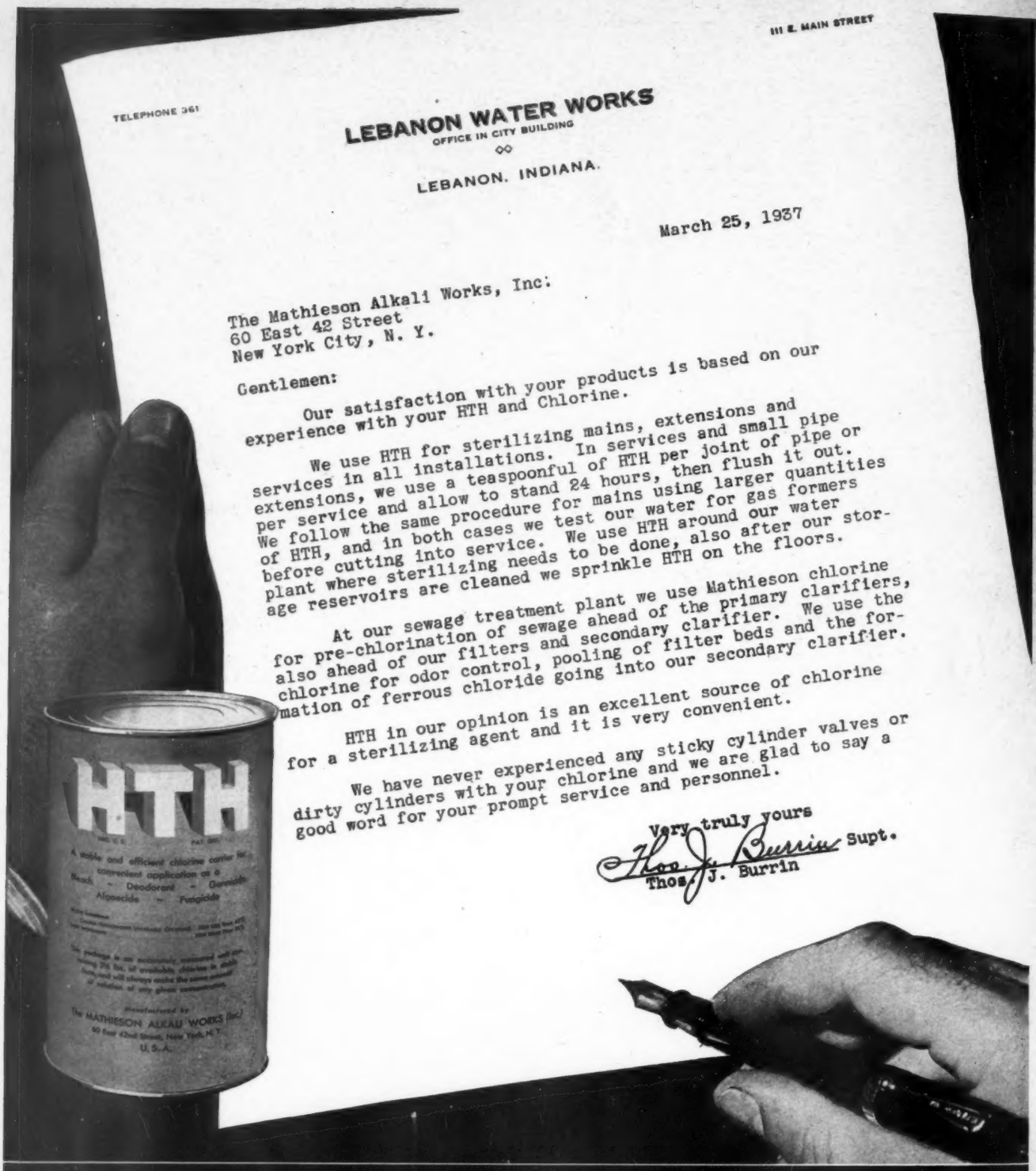
TELEPHONE 361
LEBANON WATER WORKS
OFFICE IN CITY BUILDING
LEBANON, INDIANA.
111 E. MAIN STREET
March 25, 1937
The Mathieson Alkali Works, Inc.
60 East 42 Street
New York City, N. Y.
Gentlemen:
Our satisfaction with your products is based on our experience with your HTH and Chlorine.
We use HTH for sterilizing mains, extensions and services in all installations. In services and small pipe extensions, we use a teaspoonful of HTH per joint of pipe or per service and allow to stand 24 hours, then flush it out. We follow the same procedure for mains using larger quantities of HTH, and in both cases we test our water for gas formers before cutting into service. We use HTH around our water plant where sterilizing needs to be done, also after our storage reservoirs are cleaned we sprinkle HTH on the floors.
At our sewage treatment plant we use Mathieson chlorine for pre-chlorination of sewage ahead of the primary clarifiers, also ahead of our filters and secondary clarifier. We use the chlorine for odor control, pooling of filter beds and the formation of ferrous chloride going into our secondary clarifier.
HTH in our opinion is an excellent source of chlorine for a sterilizing agent and it is very convenient.
We have never experienced any sticky cylinder valves or dirty cylinders with your chlorine and we are glad to say a good word for your prompt service and personnel.
Very truly yours
Thos. J. Burrin Supt.
Thos. J. Burrin
HTH
A stable and efficient chlorine carrier for convenient application as a
Bleach - Deodorant - Germicide
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The MATHIESON ALKALI WORKS (Inc.)
60 East 42nd Street, New York, N. Y.
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Lower Away!

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DOWN GO MAINTENANCE COSTS

with every length of

J-M TRANSITE SEWER PIPE

NO OTHER SEWER PIPE offers the same advantages as J-M Transite Pipe. Made of two enduring minerals, asbestos and cement, it offers exceptional resistance to both internal and external corrosion. Maintenance costs are practically zero. But long life is only one feature of J-M Transite Pipe. The 13-foot sections are strong, but comparatively light in weight—easily transported and easily handled. You should have complete information about this modern, economical sewer pipe. Write Johns-Manville, 22 East 40th Street, New York City.

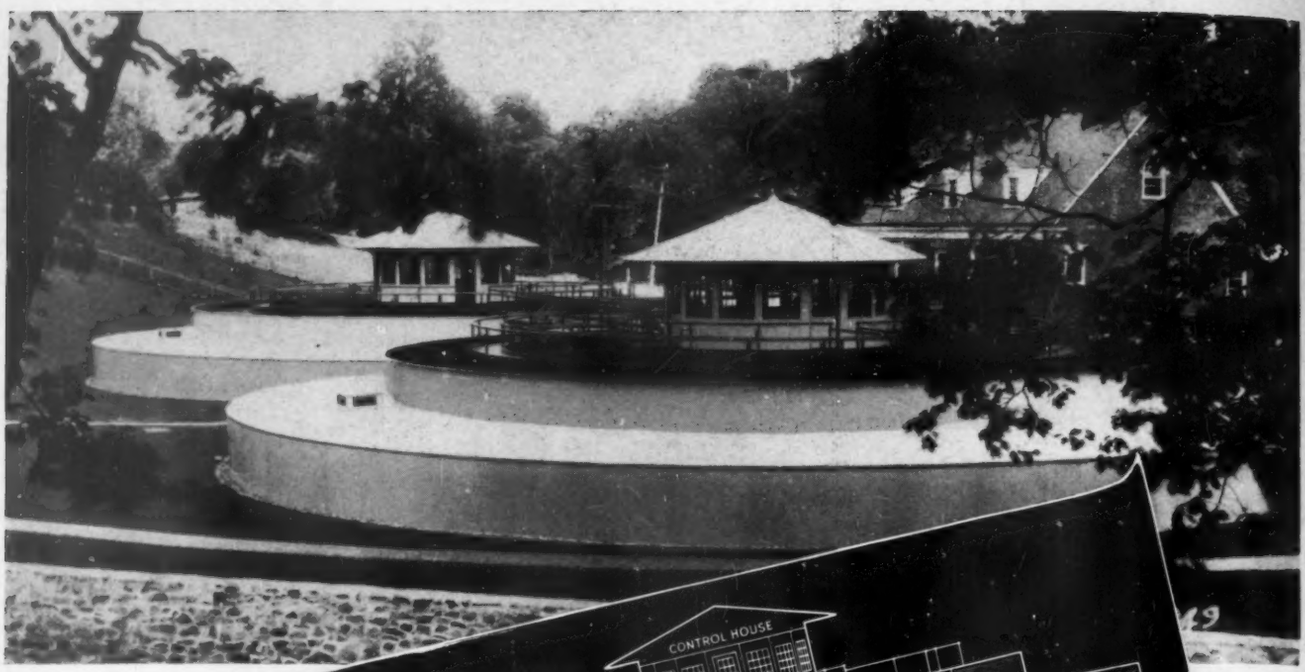
BECAUSE IT IS MADE of asbestos and cement, two unusually durable minerals, J-M Transite Pipe is highly resistant to internal and external corrosion.

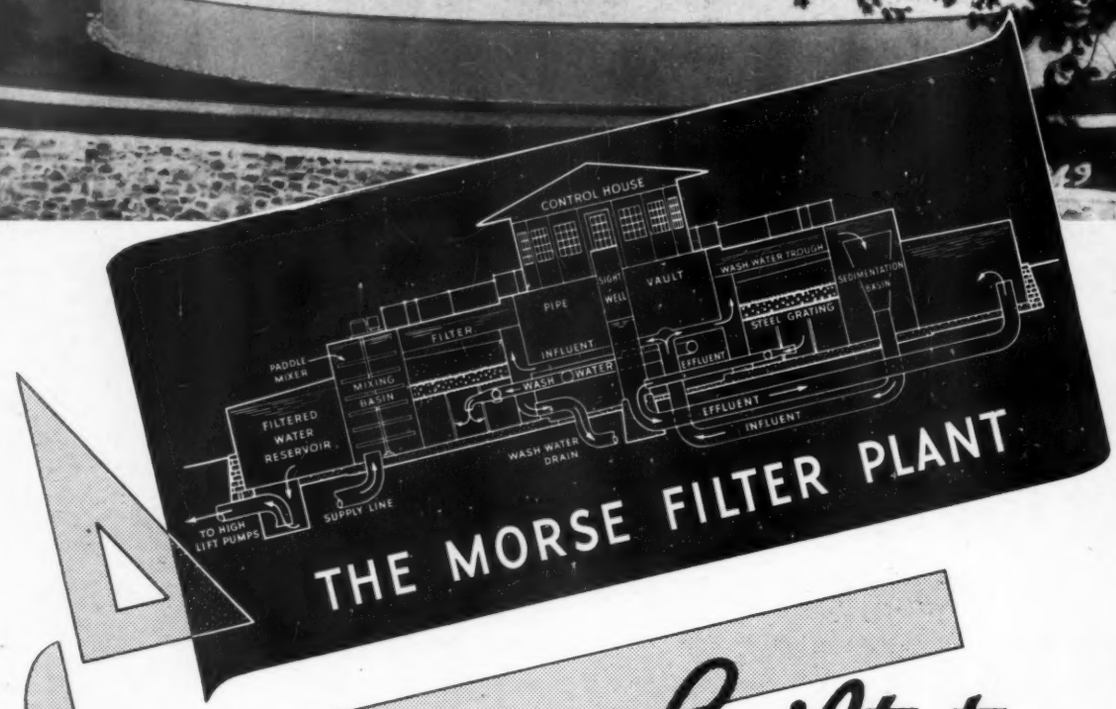
ON THIS INSTALLATION in acid marshland, Transite's unusual corrosion resistance is an important advantage. And the Simplex Couplings used on force mains assure bottle-tight joints.

JOHNS-MANVILLE J-M PRODUCTS

Johns-Manville *Transite Sewer Pipe*

AN ASBESTOS PRODUCT





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AS a water works engineer, the Morse All-Steel Filter Plant is offered to you as a new tool. With it you can do things never before practical in the field of water filtration. If necessary, units can be put in for the capacity needed at present with full assurance that additional capacity can be added economically at any time in the future.

The Morse Filter Plant is a tailor-made unit. As planned, engineered, and specified by you, it is built to exactly fit your own particular requirements. Its capabilities . . . advantages . . . limitations . . . and operating principles are covered in detail in the new bulletin "The Morse Filter Plant." Ask our nearest office for a copy.

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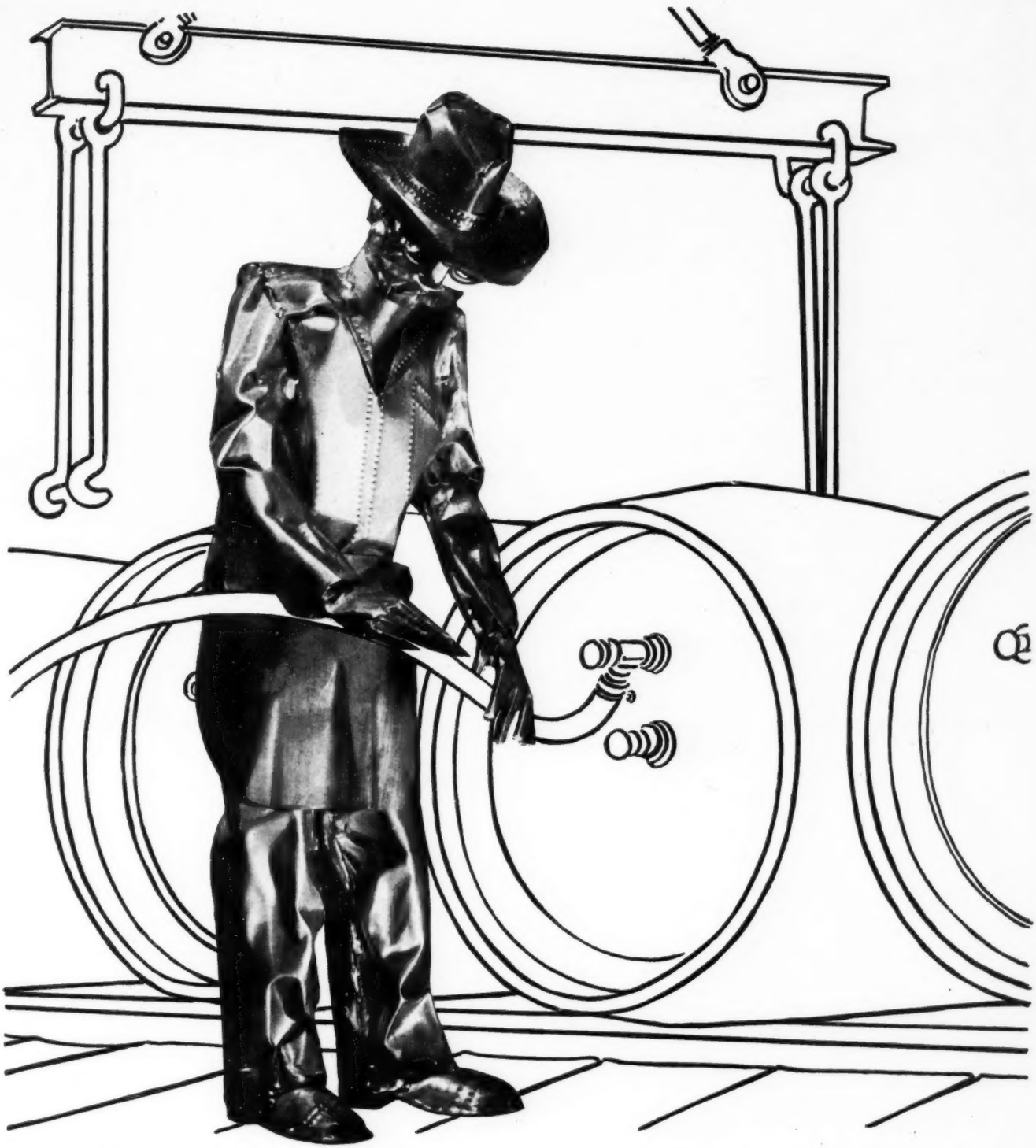

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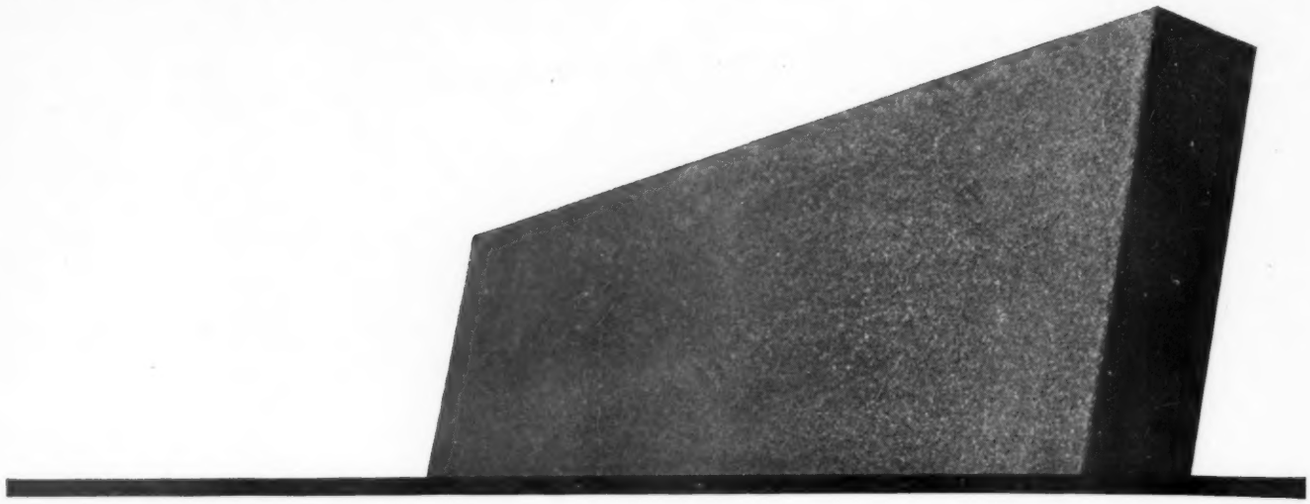
Plant: Niagara Falls, N. Y.

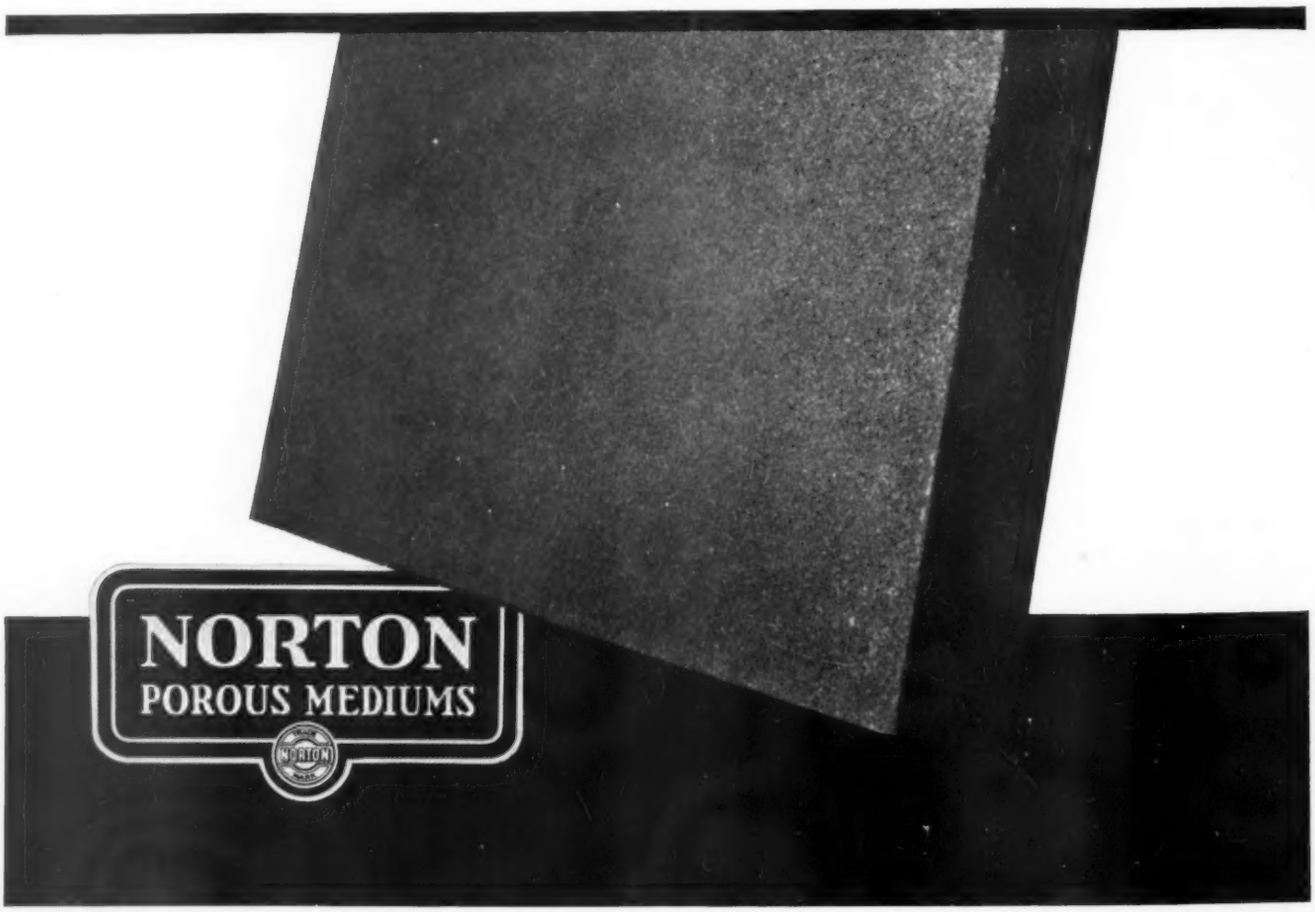
EBG Liquid Chlorine
FIRST IN THE COUNTRY



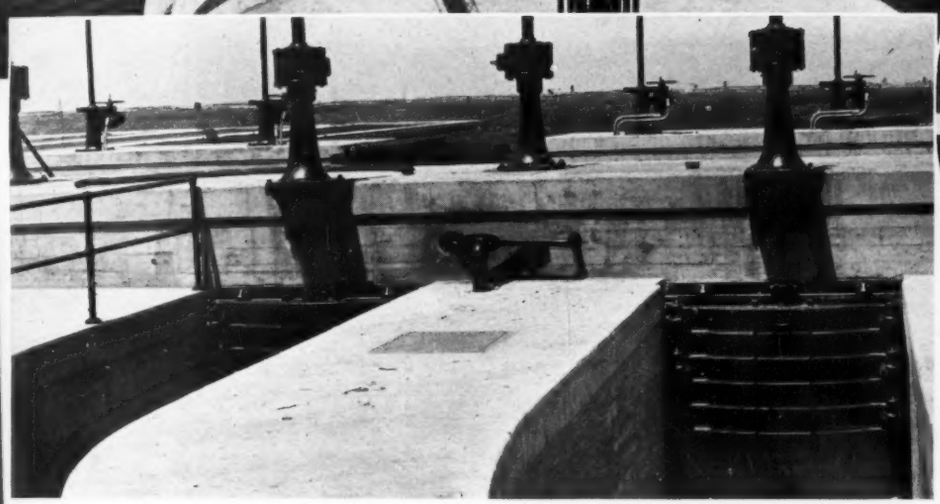
WHEN you purchase diffuser plates for your plant you want to be sure the plates will give the longest possible life and operate as efficiently as possible. Norton experience in the manufacture of diffuser plates covers thirteen years and has resulted in a plate made of grains shaped to resist plugging and with a structure to deliver air in the most efficient manner for the operation involved.

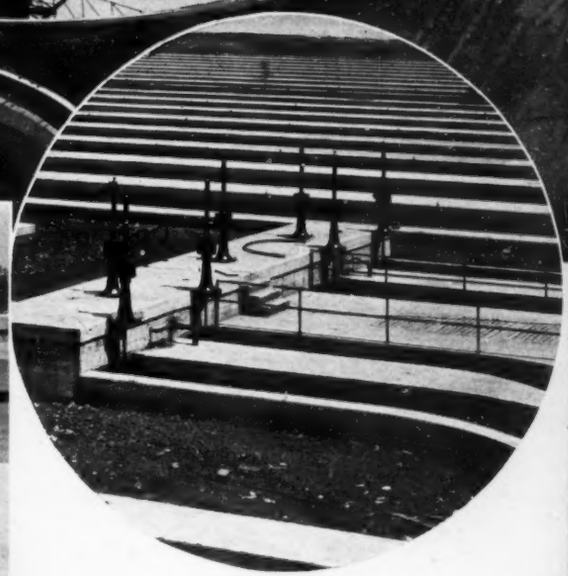
NORTON COMPANY, WORCESTER, MASS.

R-586



AT CLEVELAND





In 1933, Cleveland selected and installed Mueller-Columbian Sluice Gates and Operating Stands for their new Easterly Sewage Treatment Works. It was only natural, then, in view of the complete satisfaction these products have given, for the George B. Gascoigne Company and the Lundoff-Bicknell Company of Cleveland, Ohio, to again, in 1937, select Mueller-Columbian equipment for Cleveland's new Southerly Sewage Treatment Works.

Mueller engineering and manufacturing facilities are at your service. You will find their experience in water control projects a most valuable assistance to your problems. Data on products, service and costs will be cheerfully submitted. Write for descriptive literature today.

MUELLER CO.

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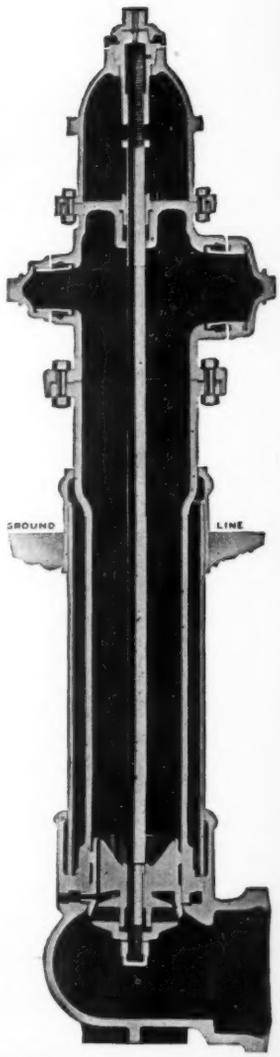
"Let it Snow. WHEN WE INSTALLED MATHEWS HYDRANTS WE BURIED OUR TROUBLES FOREVER"

Maintenance men laugh at winter—after they get Mathews Hydrants.

NO FREEZING. There's nothing that will freeze about this hydrant. Its operating threads are protected from above and below. Its barrel is emptied immediately after use by a positive and automatic drain valve. The entire hydrant is dry except when in use.

NO HEAVING. Deep frosts put a terrific strain on most hydrants. The swelling force of frozen ground pulls the hydrant away from its main, cracking castings or starting joints. But not Mathews. It is the one hydrant surrounded by a loose protection case. Frost can't heave any water-carrying part.

NO DIGGING. Plant a Mathews Hydrant, and you'll never dig it up. If a truck smashes it, you just unscrew the broken barrel and replace it from above. The same for overhauls, modernizing or grade changing. Specify Mathews. It will pay you well.



Mathews Hydrants
BUILT FOR EMERGENCIES

R. D. WOOD CO.
400 Chestnut St., Philadelphia, Pa.

manufacturers of SAND-SPUN PIPE which is centrifugally cast in sand molds, and R. D. Wood heavy-duty gate valves for water works.

HEXACHLOROETHANE

. . . one common trouble-maker that you need never encounter

A forbidding name for a mean substance—*hexachloroethane* is the impurity in liquid chlorine that causes most chlorinator irregularities. It is the chief constituent in "taffy".

Taffy is a common trouble-maker, but it is one that Pennsylvania Salt Manufacturing Company absolutely eliminates from the liquid chlorine supplied to you. Here is another instance of the progressive measures adopted by this Company to assure you a product of the highest purity.

This Company is equipped to supply liquid chlorine in any desired quantity with the utmost promptness. Our highly specialized technical service is always available to help with your difficult problems.

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PENNSYLVANIA SALT *Chemicals*

•SLUDGE•

MAKES A CHEAP COMPOST for your Municipal Parks & Gardens

USING THE

ROYER DISINTEGRATOR

In the past the organic matter for lawns, parks and gardens was derived largely from animal manure, but in recent years this source of supply has practically disappeared. It is as a substitute for this material that sewage sludge should be utilized. It should not be wasted.

Let us send you details of the machine and interesting information on the value of Disintegrated sludge as a fertilizing compost.

The Royer Sludge Disintegrator will rapidly and economically shred sludge containing from 30 to 60 per cent moisture into fine particles at a very low cost. The smallest size disintegrator will shred 2 cubic yards per hour, using a ¾ H. P. motor. Operating costs are low, as also are maintenance and repair costs.

The cheap supply of compost for municipal parks, lawns and gardens will soon pay for the disintegrator.

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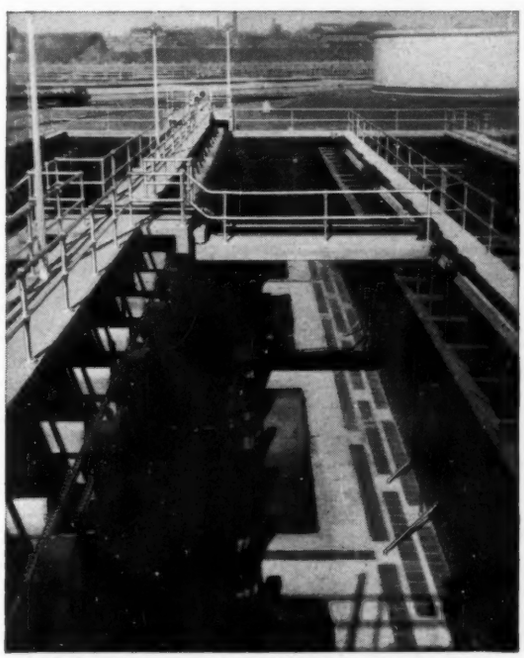
ROYER FOUNDRY & MACHINE CO.

158 Pringle St. — C. G. WIGLEY, Sole Rep. 3108 Atlantic Ave., Atlantic City, N. J. — Kingston, Pa.

FORCEFUL FACTS ON SEWAGE AERATION BY AIR DIFFUSION—No. 15

Pre-aeration accomplishes most per sewage treatment dollar

● For either preliminary or complete treatment of sewage a short period of aeration preceding sedimentation offers the most valuable single adjunct to the process as a whole. This step costs less per pound of solids removed, including grease, than any other single phase of treatment.



Modern pre-aeration tank. Diffusers at right—grease skimming mechanism at left.

GREASE SEPARATION

The diffusion of air through sewage forces emulsified particles of grease and oil to the surface for simple removal by skimming. This is the most effective and economical method yet conceived to overcome an otherwise troublesome problem.

REMOVAL OF SOLIDS

The diffusion of air through raw sewage, even though the aeration period is short, causes a definite flocculation of solids. This increases the efficiency of sedimentation upwards of 20%, based on reduction of suspended solids.

ODOR CONTROL AND DECREASED B. O. D.

The addition of oxygen to sewage in the form of diffused air prevents septic action or "sweetens" the sewage, thus controlling odors throughout the plant. Furthermore, the improved removal of suspended solids effects a correspondingly high reduction of B. O. D.

• • •

When considering aeration processes, specify Aloxite Brand Diffusers. More and more cities are using them. They give the greatest efficiency and long-term satisfaction.
Ask for our competent service on any air diffusion problems.

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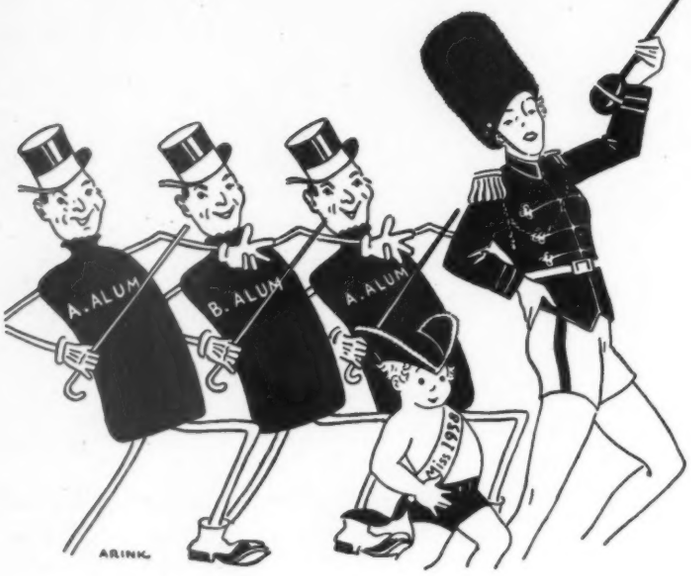

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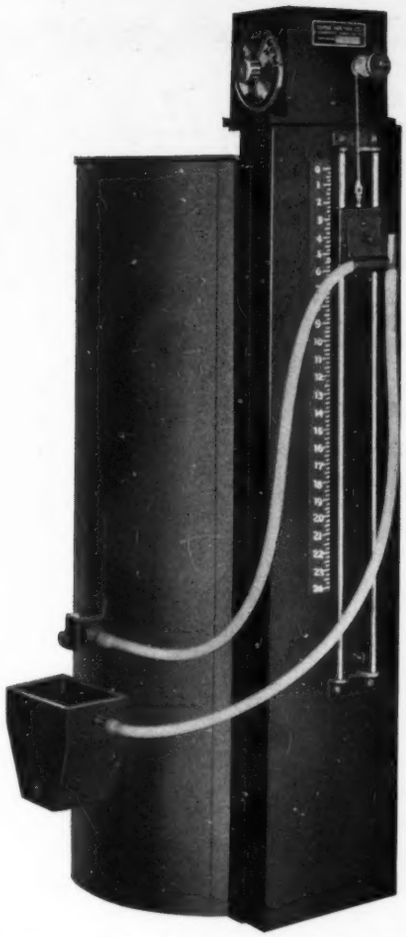

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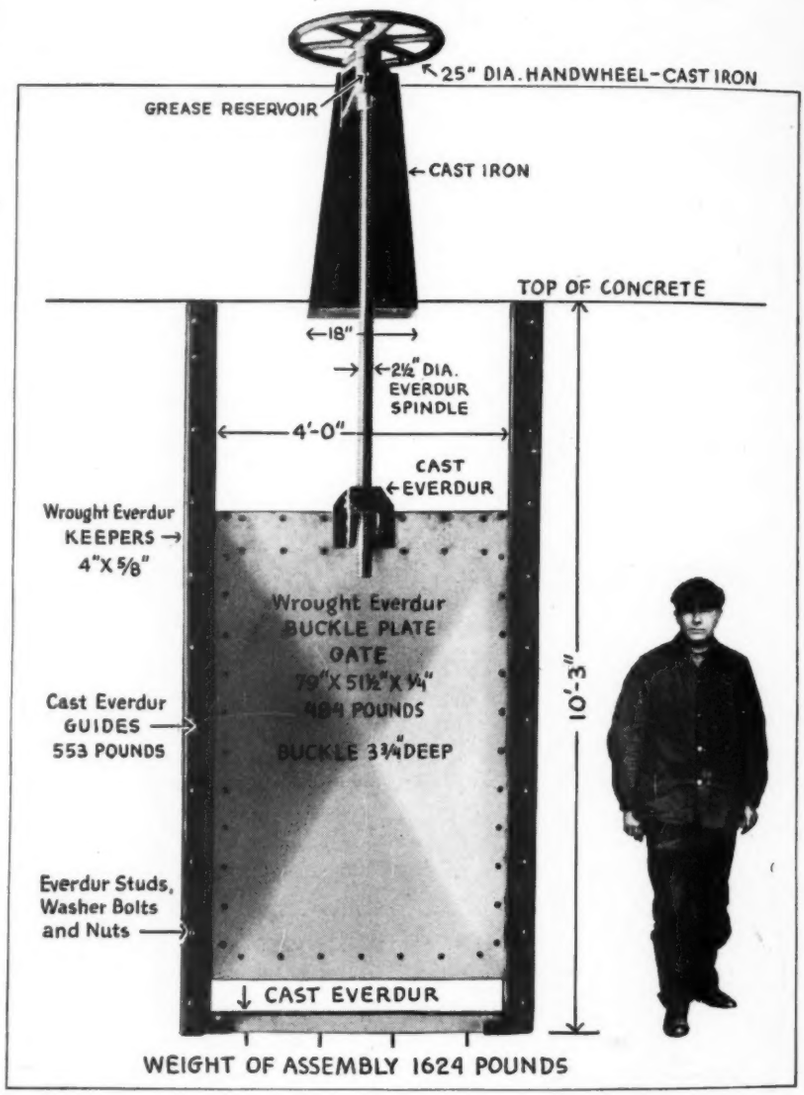

One of the five shut-off gates ready for installation in Rahway Valley Sewage Treatment Works. Designed and built by Row Engineers, Inc., N. Y. Total weight of unit, including cast-iron stand, bearings and handwheel, is 1624 pounds.

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WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

"Developments of the Year in Water Supply and Purification," scheduled feature of our first issue of the year 1938, comes from a prominent consulting engineer, now President of the Western Society of Engineers, who needs no introduction to "WATER WORKS & SEWERAGE" readers. An exceptionally able reviewer, we have been most fortunate in securing **Louis B. Howson,** of Chicago, to recount the more important developments in the field of water supply and water treatment during the year closing.

"A Symposium on Sludge Dewatering Practice" is to be featured through the courtesy of the American Society of Mechanical Engineers, under the sponsorship of which a valuable symposium on "Mechanical Sludge Dewatering Equipment, and its Operation" was staged. The three meaty papers, by engineers representing leading firms manufacturing vacuum sludge filters, constitute the "What's What" in mechanical sludge dewatering. Going beyond the features and performance of their respective filters, Engineers Pitkin, Zack and Feddler present sludge conditioner (chemical) requirements, cake dryness, yields per unit of filter area, and costs, for a representative cross-section of installations and operating conditions. Nowhere else will there be found between any two covers, so much authoritative and up to the minute information pertaining to the modern practice of dewatering sludges mechanically.

"Reclaiming and Cement Lining Cast Iron Pipes" is a contribution from **William S. Staub,** of the West Virginia Water Service Co., Charleston, W. Va., which relates his company's experience in taking up, cleaning and centrifugally lining cast-iron pipes with cement mortar. In the report covering the meeting of the West Virginia Conference of Water Works Operators, to be found elsewhere in this issue, something of the value of Mr. Staub's paper is foretold in the digest of his presentation. Step by step the author describes the design of the cleaning racks, pipe lining machine and operations. Factors to be considered, the most effective handling, and cleaning and lining procedures developed; plus a full complement of cost records of lining plant construction and operation to complete the thoroughness of Mr. Staub's worthy paper.

"Grease Removal from Sewage by Aero-Chlorination" has aroused widespread interest amongst sewage plant operators and designing engineers. So much so, that the Baltimore, Md. authorities have erected a testing plant for comparing ordinary diffused air aeration with aeration involving chlorine gas application to the diffused air, in a manner patterned after that employed at Woonstocket, Rhode Island, and recounted in the May, 1937, issue of "WATER WORKS & SEWERAGE." Accomplishments attained in the Baltimore tests, involving studies of air-chlorine ratios and detention periods, looking to efficiency with maximum economies, constitute the basis of an article by **C. E. Keefer,** Prin. Asst. Sewerage Engr., and **E. C. Cromwell,** Chief Chemist of Baltimore's Bureau of Sewers.

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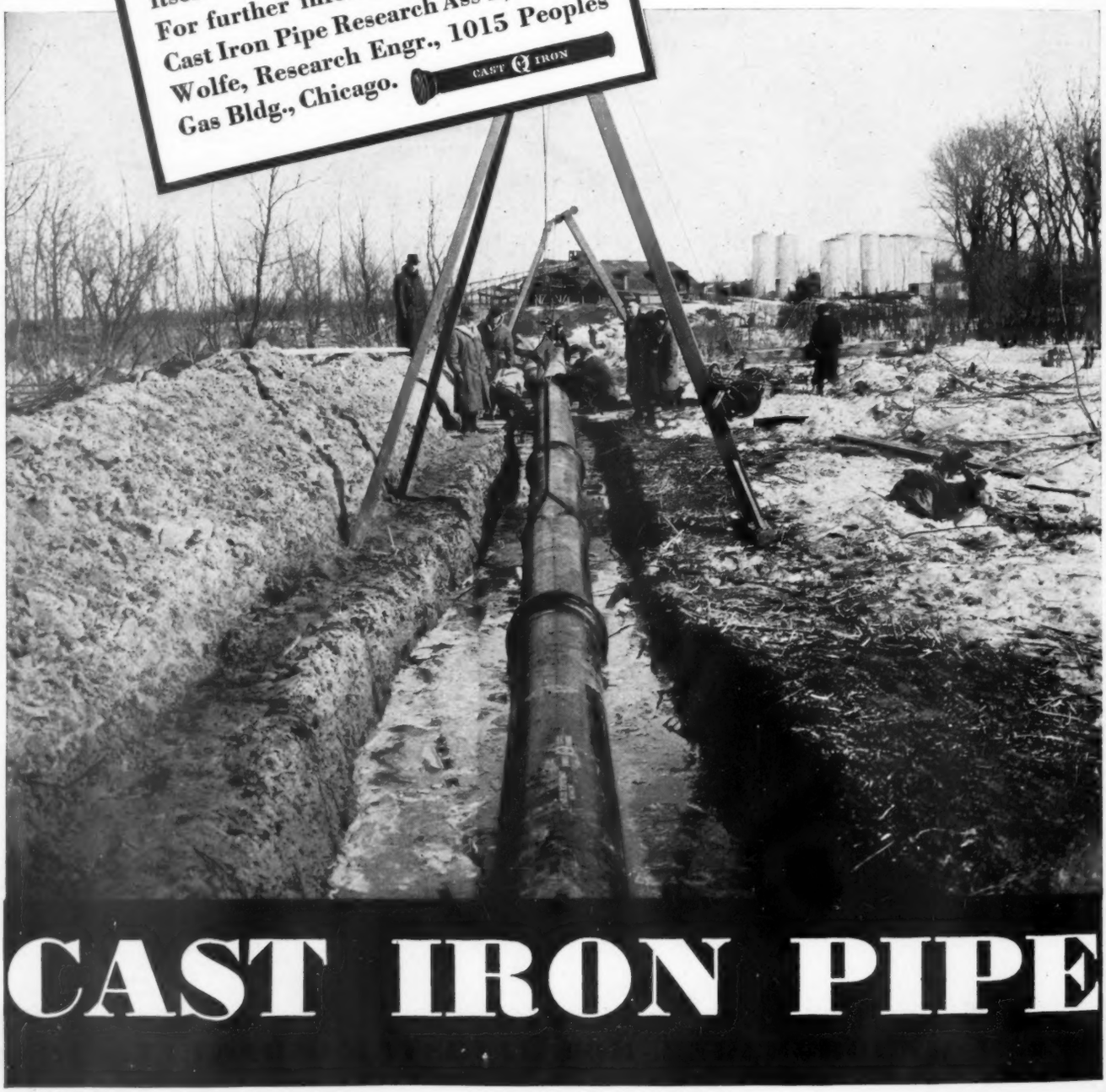


CAST IRON PIPE

WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 84 DECEMBER, 1937 No. 12

PRE-CAST CONCRETE SEGMENTS IN SEWER CONSTRUCTION

Successfully Used on the Latest London Works; Lighter, Stronger and Cheaper Than Brick; Easier to Handle Than Large Pipe

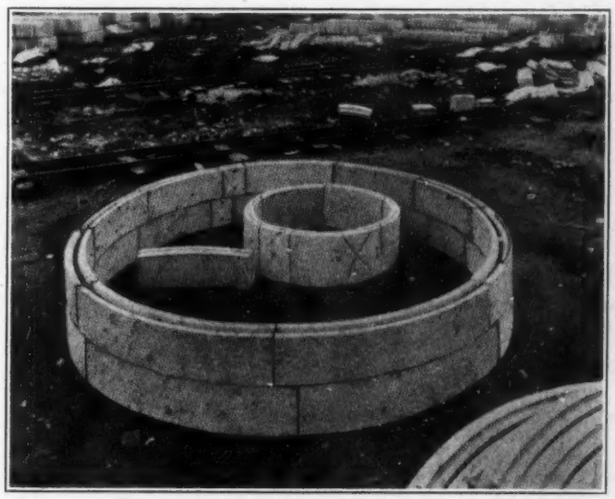
By JOHN D. WATSON
Consulting Engr.,
Ruislip (Middlesex), England

AS READERS of these columns will probably be aware, the main drainage of London proper was essentially completed about 1870 by Sir Joseph Bazalgette. Though considerably extended since then, the main works still suffice for the needs of that part of London within the jurisdiction of the London County Council, which controls all this work.

Of recent years London has extended very largely to the West and North-west in the adjacent County of Middlesex and, in order to cope with a population of about two millions and to enable several smaller disposal works to be closed down, there has come into being a very large modern disposal works at Mogden. The new works, operated by the West Middlesex Joint Sewerage Board, is one of the largest in Britain. As might be anticipated, it incorporates the latest in sewage disposal methods, including activated sludge, sludge digestion and the production of the necessary power by gas engines, operated on sludge-gas, as recounted in a previous issue of this magazine. Serving an area of 160 sq. mi. and costing some five and one-half million pounds, the scheme involves about 70 miles of main trunk sewer.

Interest in the present connection lies in the use of pre-cast concrete segments for constructing some 22½ miles of the larger sewer in tunnel. Brickwork in tunnel, which may have to be anything up to six rings in thickness, is a costly business, while the laying of pipes in tunnel calls for a comparatively large bore and considerable back fill and while excavation can be saved and the work to a certain extent simplified by the use of cast-iron segments, of which the London tube railways and some sewers are constructed, it obviously comes to be costly when it is completed with a concrete and brick lining.

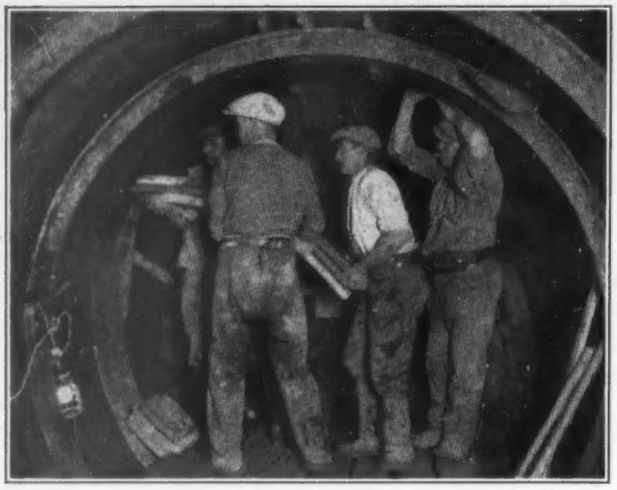
The system under review, though only extensively employed during the last four or five years, was actually introduced many years ago and used on parts of the main drainage of Glasgow by the construction firm of McAlpine and it involves the use of an exceedingly simple form of tongued and grooved pre-cast ferro concrete segment, 4 in. to 6 in. thick, 12 in. wide and in lengths suitable for the construction of sewers from 4½-ft. dia. to 12-ft. These segments (see cut) fit into one another both longitudinally and circumferentially. The actual number and width of them, composing a complete ring of lining, is determined principally by conditions governing their erection. They are erected to break joints longitudinally and a closure is effected by the use of a key segment which is slipped into position in the crown of the tunnel. During erection, steel reinforcement, bent to the correct curvature and approximately in semi-circular lengths, is built into each circumferential joint. After the erection of a complete ring the internal joints are first pointed with cement mortar and, when this is set, the reinforcement in the circumferential groove and the cavities behind the segments are pressure grouted.



The Largest and Smallest Concrete Segment Linings Used on the West Middlesex Drainage Scheme. The Largest is 11 Ft. 4 In.; the Smallest 4 Ft. 6 In. Diameter.

Construction in General

As will be apparent, these ring segments, after the putting down of suitable plant for their manufacture, are exceedingly simple to make and in the matter of the excavation to receive them this can be carried out ring by ring in place of having to be done in 6-ft. lengths or longer, as would be necessary in the case of brick sewers. On this account very little timbering is called for in good ground, because the crown of the tunnel remains unsupported for so short a time. Owing to the near proximity of the lining to the face at all times, the men are well protected from falls of the roof. For the same reason,



Workmen Placing the Segments.

when passing through bad ground, the risk of subsidence is appreciably lessened, as the area supported by the timber is never very great.

So far as sewer work is concerned, these segments are intended as a general rule to be lined internally with brick. And, apart from this strengthening the work as a whole, as will be pointed out presently, it is of considerable advantage that the tunnelling and the brick lining can be carried out continuously and separately in place of intermittently. This results in much better work with a minimum of toothings in the arch and invert after the tunnel has been driven from shaft to shaft. This will result in better alignment and the avoidance of damage to newly completed work by the succeeding shift of miners. The work, as a whole, is further simplified because the inspecting engineer can quite well look after several faces because he does not have to be present at each face throughout the whole of his shift. Prior to grouting being carried out at any face, the inspector can check the erected rings for line and level and can easily ascertain if the reinforcement has been properly placed. The efficiency of the grouting can be checked, by use of a hammer, at any time after the cement has set, and then made good if that be required. Several gangs of bricklayers can be properly looked after by one inspector.

Strength

The use of these segments in practice (though on relatively small jobs, since the idea was originally tried out in Glasgow and subsequently at Southend and Rosario (Argentina) where oval sewers were built on similar lines), demonstrated that they possessed ample strength to stand up to all normal conditions likely to be met with in this class of work. However, prior to their use on the West Middlesex works where the sewers vary between 8-ft. and 90-ft. deep, and pass under arterial roads, railways and canals, intensive experiments were carried out to test their strength. Some of these, applied to single rings, were of a comparatively simple nature, involving a two-point method of loading similar to that used by Prof. Talbot in America for testing culvert pipes. The more important of these were made on rings 2 ft. long and from 4-ft. 4-in. diameter to 11-ft. 4-in. diameter. Rings, 14 days old and assembled and jointed 7 days prior to testing, were tested in the horizontal position under two point loading. The concrete was 4:2:1 washed gravel crushed and graded from ¾-in. downwards, washed pit sand, and rapid hardening Portland cement. And, when lined with brick, this was engineering brick of uniform quality built in 2:1 cement mortar.

Generally the brick lining of these sewers is 4½ in. thick for the main purpose of resisting corrosion and erosion, though it has, in practice, been reduced to 2½ in. without any detriment. In respect to those tests carried out by the makers at their stock yard, rings 10½-ft. diameter 6 in. thick, with ⅞-in. diameter reinforcement and 4½-in. brick lining showed a strength of 2.53, as compared with similar rings of four courses of brick. Rings 5 in. thick, with 9-in. brick lining, showed a relative strength of 3.70. Without any brick lining, the relative strength fell to 0.88 of the comparable four course brick ring.

The conclusion to be reached, therefore, is that the most economical section for a 10-ft. diameter sewer is the 6-in. thick concrete segmental ring lined with 4½-in. brick; or, if the conditions are specially severe, 5-in. rings with 9-in. brick. Thus the normal thickness, even for the largest sewers, should not exceed 12 in. Although some of the main sewers in the original London works were 27 in. thick and 18 in. was quite common, but little of the work was done at less than 12 in. and then only for small sewers in favorable ground.

Compared with three course brick rings of 6-ft. diameter, the 5-in. concrete segmental rings, with ¾-in. reinforcement and lined with 2⅝-in. brick, showed a strength of 2.22; and 4-in. rings, similarly lined and reinforced, showed a strength of 1.67. In the smaller diameter of 4½-ft., which was tested in comparison with 2-brick rings, a 4½-in. unlined segment stood 1.70 of the load of the brick section, though only half the thickness. When lined with 2 in. of brick these 4½-in. thick rings showed 3.24 times the strength, while again 4-in. unlined rings proved stronger, by 1.37, than 2-brick rings. These tests, therefore, may be regarded as conclusive of the concrete segment sewer being definitely stronger than the comparable brick one, and considerably more so when lined with the minimum thickness of brick.

Destruction Tests Under Working Conditions

By means of much more elaborate equipment, installed at the Royal School of Mines, by which a vertical load of 400-ton and a horizontal one of 125-ton could be applied to 7-ft. lengths of 8-ft. diameter section, tests were made by Dr. M. A. Hogan on sections 7-ft. 10-in.

Lining a 10 Ft. 6 In. Concrete Segment Sewer. The Segments Have a Thickness of 6 In.

internal diameter, composed of seven complete rings, 12-in. wide and 5-in. thick. For the purpose of building these test sections in the machine, the lower segments were first bedded on a layer of dry sand on the floor of the machine and as the side segments were erected, they were supported against sand packed in the side sand-boxes. The upper segments were erected in the manner employed underground. After being covered with 12-in. of sand, this was levelled off to support the upper loading grillage of the machine and this, with the jacks, put on a dead load of 1.71 tons per lineal foot. While adjusting the horizontal load, this dead load appears to have caused some slight deflection of the rings, sufficient to cause the appearance of hair cracks in both soffit and invert, but these did not appear to have any subsequent effect on the strength and they disappeared when the full loading condition was reached.

During these tests, both vertical and horizontal load was applied equally till the limit of the latter was reached at round 120 tons. Then, with a constant horizontal load, the gradual increase of the vertical one led to deformation. The principal result of these tests showed that with horizontal and vertical loading of 110 tons the concrete was commencing to fail; and, with a further increase of the vertical load to 175 tons, failure occurred by direct compression along four lines 2 ft. above and 2 ft. below the horizontal diameter on each side.

A second test was made on a similar built up section, but in this case the segments had been pointed and grouted on the lines already indicated. This added to the total strength considerably and indicated that a monolithic condition had been produced, enabling the rings to stand up to a vertical loading of 38.3 ton per foot run, and a horizontal loading of 14.9 ton per foot run. That is to say, as a direct result of the grouting, the maximum load was increased 47% while at the same time the ratio of vertical to horizontal loading rose from 1½:1 to 2½:1. The horizontal support given to the rings under this test, which is comparable to the horizontal support given to a sewer properly backfilled, enables the rings to stand up to 13 times the load which can be applied by 2-point loading. Therefore, in the absence of means for carrying out a full size test on the lines indicated, the strength can be estimated at 13 times the strength under 2-point loading, assuming that there is one inch of grouting between the tunnel cut and the lining ring which provides additional strength. On the works mentioned, the use of this method of construction proved perfectly successful and the whole work has been so economically constructed that the sewerage rate per head of population is little more than one penny per week. In one particular instance, where a sewer had to be broken through to make a junction not provided for in the original plans, the bond and grouting of the completed job was found to be perfect.

▼

Locating Salt-Water Leaks in Water Wells

The U. S. Geological Survey has issued a report by Penn Livingston and Walter Lynch as Water Supply Paper 796-A on methods of locating salt-water leaks in water wells.

The report discusses four general methods of detecting salt-water leaks, known as the pumping method, the velocity method, the sampler method, and the electric-conductivity method. The equipment is described and the results obtained, from the use of the various methods in areas in Florida and Texas, are reviewed.

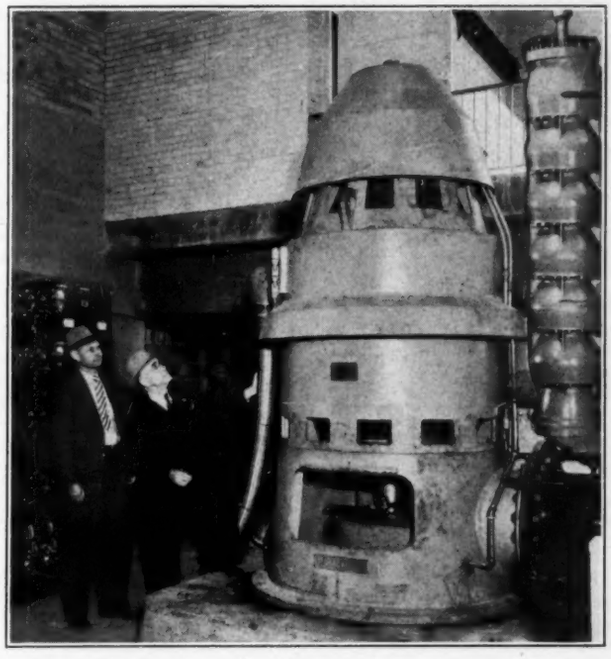
Copies of the report may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for 10 cents each.

Gigantic Deep Well Pumps Serve Spokane

Probably World's Largest

What is believed to represent the two largest deep-well pumps in the world have recently been installed by the city of Spokane, Washington, to deliver 7,500 gals. per minute, each, under a total lift of 420 ft. One of the man-dwarfing units is shown in the accompanying illustration. The motors required are 900 H.P. units, operating on 2,300 volts at 1,175 revolutions per minute.

For this installation, the turbine (pictured) is a 6 bowl unit, 24 inches in diameter, and as tall as the towering pump heads. From it runs a 20 inch riser, through



One of Spokane's Man-Dwarfing Turbines (Capacity 10 M.G.D. Each).

which the 4 inch drive shaft passes. The shaft bearings, as well as the pumps, are water lubricated. Except for size, only the standard design of enamel-lined bowls, impellers, impeller adjustment, and discharge head was employed by the manufacturer guaranteeing performance and efficiencies. The exceptionally large vertical thrust (35,000 lbs. more or less) is carried at the top of the motor assembly by a large "Rollway" thrust-bearing, in a water cooled oil bath.

The Spokane stations are equipped for remote control, with automatic start and stop, actuated by reservoir boat switches. Bearings and stator-iron are safeguarded by temperature control relays which stop the motors upon any undue temperature rise. Safety and protective interlocking features are provided to produce non-failing electrical control.

Efficiency tests have shown the plant to give wire to water efficiencies averaging almost 82 per cent, according to reports. And, with current costing 1 ct. per KWH., the pumping cost has been 0.8 cts. per 1,000 gals., pumped against the 420 ft. head at full capacity of 7,500 gals. per minute delivery for each unit.

The motors, the electrical control equipment and the control panel (see cut) were supplied by Westinghouse. The pumps were supplied by the Pomona Pump Company of California.

THE "TANK FILTER"

For the Purification of Sewage and Trade Wastes

Part II.

By DR. H. BACH*

Consulting Chemist, Berlin

In a previous issue the development of, and some operating experiences with going installations of the submerged (aerated) contact filter was recounted.

In the course of development of the "Tank-Filter", two important technical features were introduced by Dr. K. Imhoff. These greatly facilitated the working of the filter, effected savings in power required for air compression, and promoted the discharge of solids from the interior of the filter.

The "Turn-Over"

The first of these improvements concerned the recirculation of the liquid undergoing aeration in the filter, the liquid being raised by the aeration over baffles, arranged on both sides of the filter, and returning to the bottom of the filter crosswise to the general direction of the flow, as schematically indicated in Fig. 5. Such turn-over of the liquor prevents it from any short-circuiting or stratification and assures a uniform and effective aeration. Also the removal of the foam occurring in the course of the biological action was considerably facilitated thereby.

The "Pendulum" Pipe:

The other improvement was the aeration of the filter by means of an oscillating perforated pipe, instead of a fixed system of pipes or of diffuser plates. The construction of such oscillating pipe (pendulum) may be seen in Fig. 6. In using this device, there is a substantial saving of pipe material and installation work as well, plus simplification of the bottom construction of the tank. Only small power is required for the action of the pendulum, while the amount of compressed air is *considerably* reduced. As the air is blown from the oscillating pipe in stripelines, a comparatively far greater amount of air is momentarily applied to every vertical stripe of the liquid, throughout the contact material, than could be done in the case of the early installations using a system of fixed pipes arranged under the entire bottom of the filter. Thus the sludge particles present in the particular stripe of filter, acted on by the air-blow of the passing pendulum, are carried to the surface of the filter. The result was a prevention of undesired accumulations of these solids between the pieces of the contact material.

Both methods, the turn-over of the liquid and the aeration by means of an oscillating pipe, proved their usefulness in several plants and may be regarded as features greatly promoting the action of tank filters.

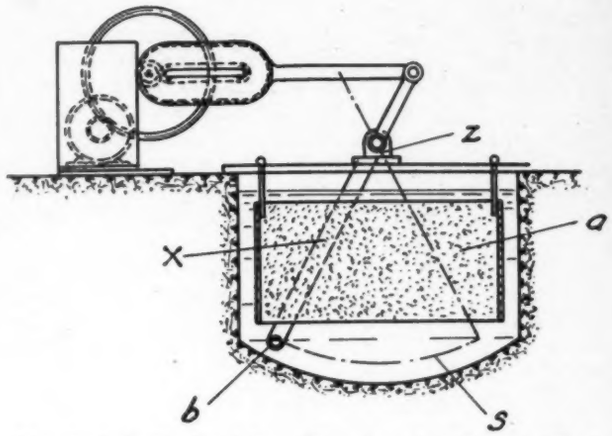


Fig. 6—Imhoff's Pendulum Pipe for Aeration of "Tank Filter"

a—basket filled with the contact material; b—air supply pipe forming the lower part of a rectangular tubular frame (x) surrounding the basket and oscillatingly mounted at its upper part in fixed bearings (z). During the reciprocation of the frame (x) the air supply pipe (b) swings along the dotted line s to-and-fro. One end of the tubular frame (x) is open and connected by means of a rubber hose to the air compressor. The other parts show the motion producing mechanism of the device

Laboratory Experiments:

I have tried the tank-filter in the course of several years in numerous laboratory experiments for treatments of industrial wastes. Besides the phenolic wastes the method has proved very effective for the purification of wastes arising in the manufacture of certain food products, especially those from breweries, whisky distilleries, starch factories, yeast factories, creameries, and the like. Basically such wastes contain plenty of organic substances which on the one hand—may cause serious nuisances in the course of aerobic digestion by demanding a tremendous amount of oxygen; on the other hand, however, making the liquids in question well suitable for biological oxidation because of the content of bacteria-nourishing material. Now it is well known that wastes of the sort mentioned resist the usual biological treatment, except when heavily diluted immediately after leaving the factory, i.e. before foul digestion (septic action) can take place. The reason is that the digestion of these wastes very

*Formerly Chief Chemist, Emschergenossenschaft, Essen.

Note.—Part I of Dr. Bach's paper is to be found in our issue of last month. This is the concluding installment.—Ed.

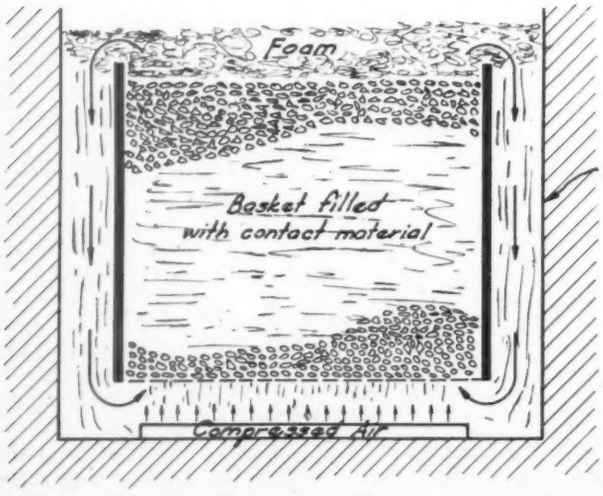


Fig. 5—Schematical Cross Section Through a "Tank-Filter," Showing the "Turn-Over" of the Water

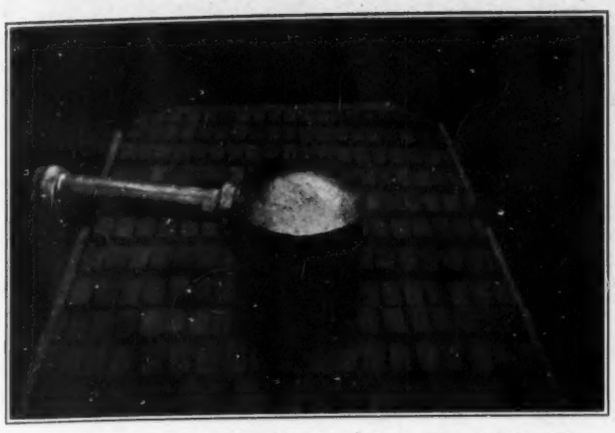


Fig. 7—Yeasts Wastes Purification Plant, Westerholt, Westphalia. Part of the Brick Floor in the Tank-Filter and the Inflow Pipe

soon produces organic acids in the presence of which the aerobic bacteria are not able to thrive and to multiply. In order to overcome these unfavorable conditions of self-acidification of the wastes in question, some experts recommended the use of lime to neutralize the acids and to establish a pH value suited for the action of aerobic bacteria. There is no doubt that in this way it is reasonably possible to effect the biological purification of the named wastes on trickling filters, as I have had opportunity to convince myself. However, such treatment includes numerous difficulties not to be mentioned here in detail, which render the work troublesome, unreliable, and unduly costly. Only to one point I would like to direct attention, i.e. the feeding difficulties of such substances as milk of lime or lime water, usually resulting in the remarkable fact that as soon as the work passes from the hand of the trained chemist to a helper, an over-dosage injuring the action of bacteria appears to be the rule. Why in such cases an under-dosage, on the contrary, do not occur may be left to psychologists.

Now I was able to demonstrate in a series of experiments conducted, that the acidity of the mentioned wastes is satisfactorily removed by the action of the tank filter, the organic acids being obviously decomposed either by pure bacterial action, promoted by the extremely favorable conditions in this filter, or by a combination of such action with direct, i.e. "chemical" oxidation (in a catalytic manner) by the air-oxygen entering the filter. I should like to emphasize that I am not able as yet to offer a scientifically valid explanation of the phenomenon in question, but that the last is nevertheless confirmed experimentally beyond any doubt.

As soon as the acid reaction disappears, leaving the liquid with a pH slightly over 7, the biological oxidation occurs in the tank filter as well as in a trickling filter or contact bed, and also by activated sludge. In the latter case, however, the inclination to bulking is greatly accentuated with such wastes containing usually a high fraction of hydrocarbons, thus ruling out this treatment. As the mentioned wastes are usually strongly concentrated, it is as a rule necessary to dilute them reasonably, eventually using for this purpose the effluent. Thus the purification of such acid wastes goes on in reality in two stages; in the first stage the organic acids are destroyed (i.e. the obstacles to the bacterial action are removed), while in the second stage the bacterial oxidation occurs. In the tank-filter both stages are fused together. The acid liquor entering the filter leaves it oxidized and slightly alkalinized without addition of any neutralizing chemicals.

Westerholt Yeast Wastes Plant:

The above mentioned laboratory results were fully confirmed in a large scale purification plant built by the Emschergenossenschaft for the wastes of a whisky distillery, producing yeast in Westerholt. Unfortunatelv the firm suffered a financial disaster and was forced to shut down only two months after the tank filter plant was put in operation. The filter material in this plant consisted of boiler slag about one inch in diameter and was ripened in ten days after which time the effluent proved constantly non-putrescible. In Fig. 7 a fraction of the grill-like brick floor and influent pipe are pictured.

Werl Yeast Wastes Plant:

For another big yeast factory in Werl the Lippeverband (Lippe River Drainage Board) installed an experimental plant, comprising a graduator for the preaeration and cooling down the dealcoholized still liquor, as the first stage of treatment. After this, followed three units operated in parallel, a trickling filter, a tank filter, and an activated sludge unit. The latter was eliminated after a few weeks' struggle, as it had proven impossible to overcome the ceaseless bulking of the sludge. The trickling filter was workable, but only with considerable difficulties chiefly caused by the liming of the acid wastes. The tank filter (Emscher-filter), however, gave very satisfactory results, the quality of the effluent allowing it to be fed to a small fishpond without any further dilution or aeration. The description of this plant and the working data were published by Dr. Sander. On the basis of the results gained in this experimental plant a full size tank filter plant was proposed by the Lipperband for the mentioned yeast factory, but after long negotiations the company resolved

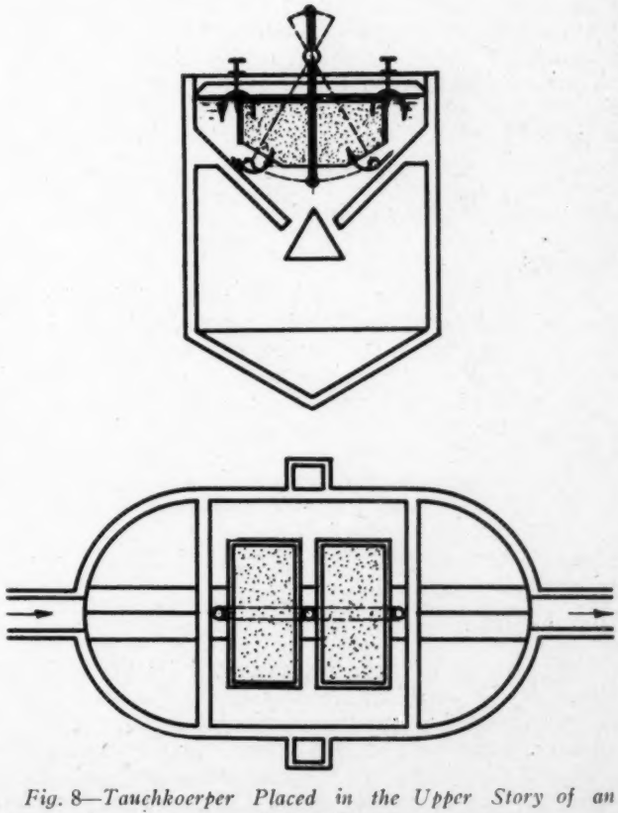


Fig. 8—Tauchkoerper Placed in the Upper Story of an Imhoff Tank

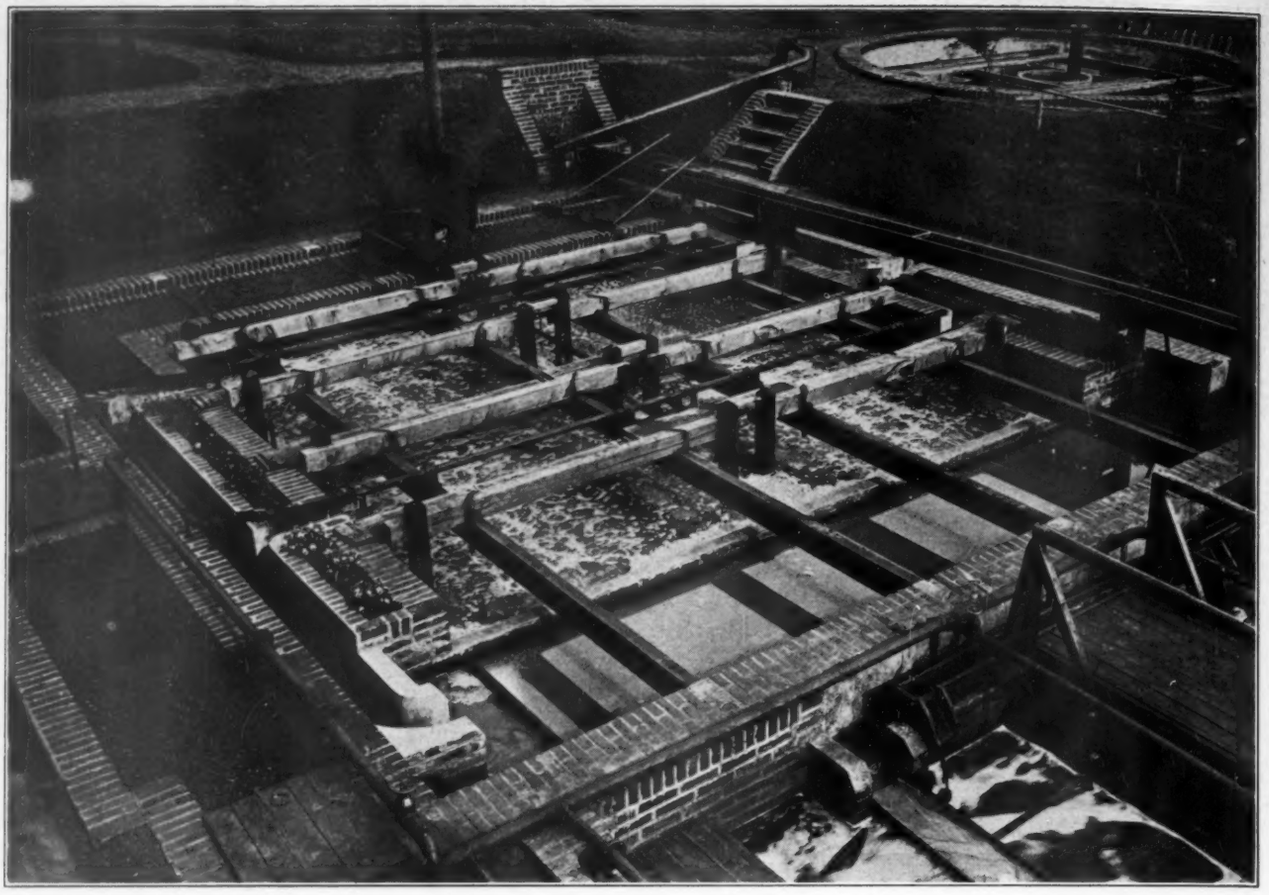


Fig. 9—Mansfeld (Ruhr) Sewage and Wastes Purification Plant. The Two Stages Biological Plant; First Stage, Tank Filters ("Emscherfilter"); Second Stage (Seen Only Partially) Activated Sludge Tanks

to evaporate the despirited still liquor in order to produce from it a fertilizer or, by burning, to recover potash. It may be pointed out that such enterprise is somewhat risky as depending on the changeable market situation of potash while the high investment costs of the evaporation and calcination plant and the working expenses are unavoidable. In the case of the mentioned factory, the erection of the potash recovery plant lessened only partially the pollution of the river,, without solving the problems definitely.

Deoiling:

Very efficient has the tank filter proved for the purpose of deoiling some oil laden wastes, although in this case the action of the device seems chiefly to be a mechanical one. Experiments of the Ruhrverband in Essen showed that by passing the oily wastes through a tank filter, while applying compressed air from the bottom of the tank, the oils separate from the water and become enveloped in the foam accumulating on the top of the filter. From here the oily foam is easily removed by simple mechanical means to a separate chamber and eventually worked up in a suitable manner for the recovery of the oil.

Kettwig Plant:

An example of such plant erected by the Ruhrverband may be found at Kettwig (Ruhr) treating the oil laden wastes of a large wool spinning and weaving mill. Similar plants were installed for other oily wastes.

For the purification of domestic sewages tank filters were applied in several cases. In some constructions of the Ruhrverband tank filters were combined with Imhoff tanks in such manner that in a two-pit plant the first Imhoff tank served as clarifier of the raw sewage while in the sedimentation chamber of the second was immersed the filter, aerated by compressed air blown from the bottom by means of an oscillating perforated pipe (pendulum) as shown in Fig. 8. Thus the second Imhoff tank was really converted into an aerobic biological purifier. Such construction shows the advantage that the sludge forming in the filter discharges immediately into the sludge digestion chamber which represents the lower story of the Imhoff tank. Assuming a sufficient length of the sedimentation chamber in an Imhoff tank, it may be even possible in a single pit plant to use the inflow part of this chamber for some length for plain sedimentation of the incoming sewage and arrange in the rest of the chamber, extending to the outlet side, a contact aerator.

Use in Domestic Sewage Treatment:

In other instances, tank filters were inserted between two Imhoff tanks, the first serving as usual for the sedimentation of incoming sewage and the second as final clarifier separating the humus from the biologically purified effluent. As such arrangement allows alternate changes of the flow direction of the sewage, the sludge digestion chambers in both Imhoff tanks become evenly charged with both sorts of sludge, and discharge a uniform product of the well known Imhoff sludge character.

In a similar manner tank filters may also be inserted between mechanical clarifiers and separate digestion tanks. And, sometimes, it may prove useful to arrange tank filters in stages or use them as one stage in multistage treatment plants.

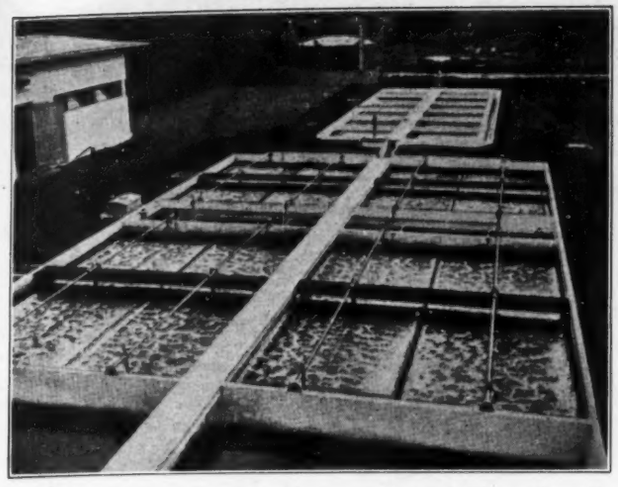


Fig. 10—Hattingen (Ruhr) Sewage Disposal Plant. Imhoff Tanks in the Rear, Two Stages of Tank-Filters in the Foreground

Mansfeld Plant:

Such treatment was applied by the Ruhrverband to the sewage of the Mansfeld colliery miners' settlement in the Ruhr coal district. To the sewer in question is also discharged the soft coal washings and the phenolic wastes of the ammonia recovery plant. After sedimentation in a flat basin, fitted with drains, the sewage entered the tank filters forming the first biological stage and thereafter the second stage consisting of an activated sludge arrangement. The bulk of the phenols present in the influent was destroyed in the tank filters (the first stage), the activated sludge stage received the dephenolated liquid and acted in reality as a finishing or refining stage. (Fig. 9.)

Hattingen Plant:

For the industrial city of Hattingen the Ruhrverband has installed a sewage disposal plant comprising Imhoff tanks and two stages of tank filters. (Fig. 10.) For the contact material in these filters cork cubes were used (some 1½ in. square) placed in a cage so that the latter could be easily lifted from the water in the case a cleaning of the contact material appeared necessary.

Danzig Plant Design:

A project for a sewage disposal plant for the city of Danzig, provides tank filters as the first stage biological purification, followed by activated sludge treatment.

Franz Colliery Plant:

In the colliery Franz at Langendreer a small but very efficient tank filter plant built by the Lippeverband (project of Dr. Prüss and Blunk) is employed for the purification of sewage from coal miners' lavatories. The sewage is pretreated in an Imhoff tank. The effluent discharges crystal clear, like drinking water.

Van Laaren Experimental Plant:

There may be mentioned an experimental plant in the sanatorium Van Laaren (in Holland) described by Dr. Van der Zee who rendered a meritorious work in scientific investigation of the action of tank filters. Also in the city of Leipzig, sewage disposal plant and in other places, experiments with tank filters were conducted, but these have only partially been published.

Conclusions:

As may be deduced from the above statements, the tank filter method has proved successful in various cases where applied, but its adaptation has not spread along with the methods of general popularity, such as activated sludge or trickling filters. In my discussion I intended only to direct professional attention to this somewhat neglected but useful device for de-colloidizing sewages and reducing putrescence economically, either as a single or a primary stage treatment device. Further technical particulars may be found in the literature quoted below. To summarize: the tank filter method may be regarded as a suitable means for the biological purification of various industrial wastes, including de-oiling of waste liquids; and, generally, as a useful device in sewage treatment, to function at low cost and without deleterious set-backs from over-loadings or industrial discharges into domestic sewages.

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OHIO CONFERENCE ON SEWAGE TREATMENT

Holds 11th Annual Meeting in Cincinnati

THE 11th Annual Meeting of the Ohio Conference on Sewage Treatment was held October 19th and 20th in Cincinnati, Ohio. Officially registered were 85 members; 48 associate members and guests—the total registration being 133.

Mayor Wilson and Wallace Biery

Taking time out from a heated political campaign, Cincinnati's busy and witty Mayor—Russell Wilson—was the principal speaker at the annual dinner, presided over by F. H. Waring, Chief Engineer of Ohio's Department of Health. Following the Mayor came Wallace Biery—live-wire representative of Cincinnati's Chamber of Commerce, as chairman of its active Committee on Stream Pollution. Mr. Biery has spent the best part of the past two years in Washington on proposed Federal stream pollution legislation, and in organizing interests in the Ohio River Basin, looking toward pollution control of America's most important water course serving vast industry and 17,000,000 people—5,000,000 of which derive water supply therefrom.

The Mayor's witty style of speaking brought forth many a good laugh and he regretted having to leave, to turn his attention to "another form of sewage disposal; namely, political campaign." The need for cleaning up river pollution was stressed by the Mayor. He disclosed that Cincinnati's 10-year program, involving a $20,000,000 expenditure for improvements, had in it the revamping of sewers and construction of sewage treatment plants. Cincinnati, he said, could boast the eminently practical J. E. Root as its City Engineer and Director of Public Works.

Following Mayor Wilson, Mr. Biery reviewed the movement fostered by the Cincinnati Chamber of Commerce in respect to evolving an Ohio River Basin Compact in which, he said, 6 states had already reached an agreement. He recounted the part taken by Cincinnati's Committee on Stream Pollution, in arousing Federal interest in the matter and in getting anti-pollution bills introduced in the two houses of the Congress. He presented the features of the desirable Barkley-Vinson bill which, because of its cooperative nature, had proved acceptable to municipalities and industry, and had been endorsed by leading associations representing water supply and sewerage interests. He explained that a compromise attempt, to combine the Federal enforcement features of the too drastic Lonergan Bill with the cooperative Barkley-Vinson Bill, had proved unsatisfactory to the Ohio Basin Committee and other supporters of the more friendly bill. The result had been to keep the desirable bill (already voted by the House) from coming to vote in the Senate. When it could be put in shape for acceptable introduction remained unknown but he pled the support of the Conference toward House Bill 2711. Later in the meeting the Conference voted a resolution reaffirming its approval of this Bill, as many other associations have done. Mr. Biery received a rising vote of thanks to himself, his Committee, and the Cincinnati Chamber of Commerce for the time, the effort, and the funds, devoted to furthering equitable stream pollution abatement.

G. Albro Hall (Marion), Retiring Chairman.

J. H. Wenger (Westerville), Incoming Chairman.

Toastmaster and Speaker: F. Holman Waring and Wallace Biery.

Proceedings Available to Non-Members

In his report as Secretary, the Editor, Bruce McDill, reported that Proceedings of the Conference for the years 1933 and 1934, (skipped during the depression) had been printed and were ready for distribution to complete the files of the Proceedings. Entirely financed from registration fees and sales, to non-registrants at meetings, copies of Proceedings from 1933 forward are being offered at $1.00 per copy. The report of the Treasurer indicated a small deficit on the Proceedings which would be made up probably through additional sales to non-members, extra copies having been printed for the purpose.

Ohio's Operator Certification Act

"Regulations Governing Operating Personnel of Water and Sewage Treatment Works," recently put into effect for Ohio operators, was reviewed by F. D. STEWART, Prin. Ass't Engr. of the State Department of Health. Mr. Stewart explained that the new "Regulations" had been drawn by a committee representing the two Ohio Conferences, composed of operators and man-

Officers

C. D. McGuire (Columbus), Board of Control, F.S.W.A.; F. E. Harroun (Akron), Treasurer; F. W. Jones (Cleveland), Board of Control, F.S.W.A.

agers of water and sewage treatment plants, which worked laboriously with engineers of the State Dept. of Health. Having been already distributed and now accepted by the State Health Commission on Sept. 22, 1937, Mr. Stewart's review was taken step by step for answering questions, and for open discussion by the membership.

In Ohio, a "Licensing Act" does not seem a necessity at this time and the required "Certification" of operators by the State Health Department seems more workable and appropriate under existing law. Operators will be examined for operator Certificates by a member board, composed of operating members of the two Conferences, two members from the sanitary engineer field at large and one engineer from the State Department of Health. For application, examinations or certification no fee is required. (Later in the meeting the following Examining Board was announced—R. W. Furman (Toledo); T. C. Schaetzle (Akron); A. E. Kimberly (Columbus, Cons. Engr.); Prof. Geo. E. Barnes (Case School, Cleveland); F. D. Stewart, representing the Dept. of Health.)

High-lights of the "Regulations" are:

(1) Private corporations, as well as institutions will be required to employ one, or more, trained operators or supervisors of a grade required by and "certified" by the State Department of Health.

(2) The corporation or municipality may select the individual, or individuals, to be presented for examination and certification.

(3) Operators and plants will be classified according to type of plants and responsibility of positions, in Classes A, B, C, D, and certificates of the class warranted issued accordingly. More than one operator on a given plant *may* be required to qualify and be certified. Where one certified operator is considered sufficient, assistant operators and sub-operators may make optional application and become certified to grades allowed by the examining board. (Basic qualifications for each grade being set forth in the "Rules.")

(4) The all important "Grandfather Clause" protects existing operators in responsible charge up to January 1, 1938. These men are allowed the 15 months in which to file application, accompanied by qualifications. Without examination of such individuals, the board will recommend for or against certification to the grade applied for. Border line cases are subject to further review and certification in grades lower than applied for if the board so recommends. After January 1, 1938, *all* operators requiring compulsory certification must appear before the Rating Board of examination.

(5) In no case are fees required of applicants for certification.

In the discussion, Mr. Stewart stated that the important steps ahead were the proper classification of plants. And, further, individual consideration was essential as to how far down the line certification of assistant or sub-operators should apply. A member objected to not granting certificates to sub-operators qualified to pass requirements. To this, Mr. Stewart replied that voluntary applications were in order from any qualified operating individual, the important consideration was how far down should compulsory certification reach.

J. W. Ellms (Cleveland), Commissioner of Sewerage. (40 Years Ago He Started Cincinnati's Filtration Plant.)

F. D. Stewart (Columbus), Prin. Asst. Engr., State Dept. Health. (Explained Ohio's New Operator Certification Regulations.)

Treatment Plant Superintendent Programmers

M. W. Tatlock, Dayton (Still Building Filters from Fertilizer Profits); C. C. Hommon, Canton (Makes No Charge for Detective Work); Jas. R. Collier, Elyria (Septic Sewage Put Him with the "By-Passers.")

L. H. ENSLOW complimented those responsible for the neat and equitable drafting of the "Grandfather Clause," to preclude possible embarrassment to existing qualified operators. Also, the liberal allowance of time for qualifying—this making it possible for an operator to improve his qualifications, within the legal time limit, for a higher classification before coming up for certification.

New Officers

The nominating committee endorsed the following as officers for the ensuing year. The vote was unanimous:

Chairman—J. H. Wenger, Supt. of Treatment, Westerville.

Vice-Chairman—J. J. Wirts, Supt. of Treatment, Cleveland.

Secretary and Editor—Bruce M. McDill, State Dept. Health, Columbus.

Treasurer—F. E. Harroun, Ass't Supt. Treatment, Akron.

As Member-at-Large to the Executive Committee—Ben H. Barton, Supt. of Treatment, Findlay.

To serve on the Board of Control of the Federation of Sewage Works Associations—C. D. McGuire, Supt. of

J. K. Hoskins (Cincinnati), Senior San. Engr., (Chamber of Commerce Discovered Him — "Right in Cincinnati.")

J. E. Root (Cincinnati), Director of Works. (Mayor Wilson Is Proud of Him; Am. Soc. Munic. Engrs. Made Him President.)

Treatment, Columbus; and F. W. Jones, of Geo. B. Gascoigne, Engrs., Cleveland.

Papers and Discussions

"The Design of Small Treatment Plants," by W. HOMER KNOX, Assistant Engineer, Department of Health, Columbus, Ohio.

Mr. Knox in a paper, the context of which was based on experiences and observations, outlined fundamental considerations to be given by engineers in designing small treatment plants. This digest will not attempt to touch on the numerous items to which attention was directed. Amongst the more important and less obvious consideration, however, were the following:

For many years Departments of Health have preached against placing by-passing arrangements in sewage treatment works. Ears were up when Mr. Knox prescribed adequate arragements for by-passing units of the plant, or the plant in whole, as an *"essential element"* of the design of successful plants.

One common deficiency in small plants should not continue, viz., the absence of adequate flow measuring (preferably recording), devices. Bar screens, and production therefrom, should be concealed from view of visitors. The odorous room should be stack-vented. Imhoff tanks suffering a black-eye, chargeable to non-attention and under-design in sludge capacity, still deserved a place in the smaller designs. Imhoff gas-vents should be as small as practicable—20% area of the tank being the upper limit. From a point 6 inches below the slot, capacity for sludge should be 2.5 cu. ft. per capita minimum. For mechanically cleaned tanks the circular or oblong design had proved preferable to square tanks, and 2 hour detention should be the minimum for small units.

Chemical precipitation, admittedly not as practical for small as for large plants, deserved consideration as a method of treatment to cope with high seasonal loadings, such as those represented by industrial wastes or temporary population loadings. Important in this consideration was an effective coagulating device proving a 30-minute flocculating period. As to the Activated Sludge process, it should in general be avoided for small plants, unless some specific reason justified the high operating cost and degree of supervision necessary. On the same score sprinkling filters were to be preferred to sand filters.

As a secondary device for small works, the trickling-filter stood out—preferably those with revolving distributors, when considering all factors. And, always design for filter flooding to control fly breeding. En route to such distributors settled sewage should pass through a screen of ¼-in. mesh wire. Loadings should not exceed 2,500 persons per/acre/foot; or more scientifically, 250 lbs. B.O.D. per acre/ft. In final tanks 1-hour detention was recommended, with humus sludge—return to crude sewage. At a reasonable cost, polishing of effluents by straining through sand or magnetite filters was to be desired in most types of plants.

Digestion tank capacities, held as minimum, were 3 cu. ft. per capita for unheated tanks; 2 ft. for heated tanks. Supernatant liquor should be disposed of in lagoons or on sand beds. Delivery of such to the inflowing crude sewage, as frequently practiced, usually gave rise to odors, and other operating troubles. Open sludge beds, usually the least costly, required areas of 2 sq. ft./capita, or more; glass covered beds 0.75 sq. ft., by actual comparable observations. For sludge cake removal, most practical had been the travelling bucket on an overhead rail.

Chlorination, in its multiple adaptations, should be installed to provide pre and/or post chlorination. This, since reasons for pre-chlorination seemed to be increasing at the majority of plants. Equipment to provide chlorine dosages of 15 to 20 parts per million, based on

1. Frank Roe, Carborundum Co.; 2. H. B. Bacherms, Sewerage Engr., Greenhills Resettlement, Hamilton County, Ohio; 3. Frank Taylor, Supt., Water and Sewerage, Defiance; 4. Harry Potts, Penna. Salt Co.; 5. Harry Lautenschlager, Chief Operator, Orville; 6. D. S. Blosser, Chief Operator, Columbus Grove; 7. Milton Speigel, Chicago Pump Co.; 8. Bert Brumm, "Water Works and Sewerage," Cleveland.

Plant Superintendents

T. C. Schaetzle, Akron; G. E. Flower, Cleveland; R. A. Allton, Columbus.

average flows, should be provided to meet possible demands.

In concluding his "hints to designers" Mr. Knox pointed to the value of securing constructive criticism and suggestions from operators, while the design was still in the process of evolution. Due consideration to economy of design was, in his opinion, to be outranked by consideration of simplicity and economy of maintenance and operation; and, the all important factor, overall satisfaction to owner, supervising agencies, as well as the designer himself.

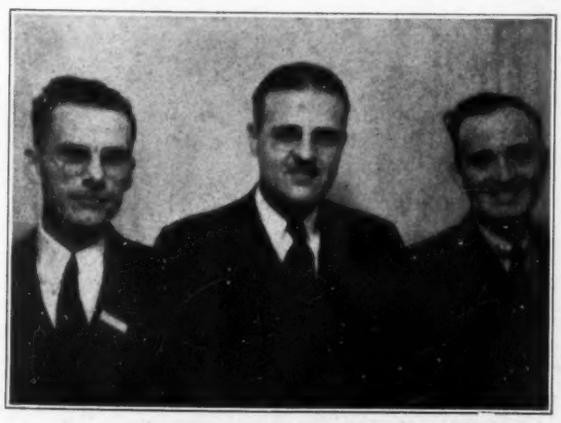
R. F. MACDOWELL, Cons. Engr. (Cleveland), not wholly in accord with all that Mr. Knox had said, pointed out the possibilities of elevated trunk sewers to reach treatment plants and preclude the need of pumping. Further, to the greater need for tight sewers in small than large systems, because of the proportionately greater cost for providing for wet-weather flows in small works; also, the effect of such flows on plant performance. In small design, where the activated sludge process is to be provided, mechanical aeration seemed preferable to air blowing. Based on experience, stop-gates were best made of "Everdur" or aluminum. Likewise, aluminum gratings were preferred. The importance of providing water supply or effluent supply for flushing had not been emphasized sufficiently. In gambling on population growth, and life of the plant, it was hazardous to cut corners in small plant design. For the sake of operation, an ample complement of tools and adjuncts should be included in the original contract if their purchase was to be assured.

C. C. WALKER, Cons. Engr. (Columbus), spoke on the necessity of considering operating costs as a primary consideration in small plant design. Chemical treatment seemed to come in for increasing attention, the more that the problems varied. Sewer rental in small towns had best be considered in the design stage, and held down for the happiness of all.

F. W. JONES of Geo. B. Gascoigne Engrs. (Cleveland), commented on the two essentials of treatment works—the sludge lagoon and the by-pass. Then added, that plant beautification was not to be overlooked, even in the smaller works.

"The Technical Supervisor—His Relationship to the Plant Operator and Municipal Officials," by CHAS. C. HOMMON, Supt. Treatment Works, Canton, Ohio.

Mr. Hommon, enriched with much experience as a technical supervisor of a number of small plants, and operating a large plant, related several of his experiences to illustrate the benefits to be derived by small communities served by a "circuit-riding" technical supervisor. After training the local operator in matters of efficient routine operation, not the least important job of the supervisor was to keep the municipal authority out of hot water with the State authorities. The maintenance of records of plant performance, weather conditions, stream quality below the plants, all had their value in damage suits. This was one contribution of the technical supervisor. He told of interesting experiences in sleuthing for evidence to combat damage claims by riparian owners; of substituting for a sewer superintendent in solving sewer problems; as a consulting engineer in other directions. His job, somewhat like the family doctor called in for "Pop" and then having to diagnose and prescribe for little Johnny and the pet dog, Mr. Hommon frequently finds himself called to the long distance 'phone to prescribe for this and that municipal "head-ache." But, he said, it's all in the day's work, provided there's not too much of it. He also finds technical supervision has proved of considerable value when engineers, retained to design plant betterments, need basic data to facilitate economic design.



Across the Continent

From Topeka, Kan.—Dan E. Rupp, Plant Supt.; from Boston, Mass.—H. P. Eddy, Consulting Engr.; from Columbus —C. C. Walker, Consulting Engr.

Northwest-Ohio Sewerage Conference "Brass Hats"

Ben H. Barton (Findlay), President; A. H. Niles (Toledo), Secretary; A. F. Redruf (Van Wert), Vice Pres.

Cincinnati Looking to Sewage Treatment

"Sewerage and Sewage Disposal at Cincinnati," by J. E. ROOT, Director of Public Works, Cincinnati.

Mr. Root reviewed the findings from various surveys showing progressively poorer sanitary quality of the Ohio River at Cincinnati, and the effect of the series of dams constructed on the river. One built just below Cincinnati created a settling basin (20-mile flow in 4 1/6th days, at low water) for its sewage, causing at times up-stream flows of the polluted Little Miami all the way to Cincinnati's own water works intake. This dam had complicated the local waste disposal problem in other directions. Realizing the necessity of securing treatment of sewage and industrial wastes, Mr. Root discussed the problem of sewer construction and plant locations, brought about by the topography of the city and the marked fluctuations of the Ohio; but, said that plans would go forward notwithstanding the unavoidable high costs to be met.

"Stream Pollution Surveys—The Plan, Organization and Method of Conduction," by J. K. HOSKINS, Senior Sanitary Engineer, U.S.P.H.S., Cincinnati.

Mr. Hoskins presented a sketchy outline of procedures, personnel, and equipment requisite in undertaking stream pollution surveys and self purification studies, such as have been made in numerous instances on the Ohio and other streams by the U. S. Public Health Service. The gathering and recording of flow, precipitation and pollution loading data on large streams ran into impressive magnitude as did the numbers of weekly sam-

ples of water and monthly samples of bottom mud collected and examined. Many field laboratories were required to make examinations possible within 6 hours after sampling. All data went to the central offices at Cincinnati for laborious compiling, study and evaluation, and preparation for publication. In making examinations, the Standard Methods of Analysis were adhered to and, in addition, long period oxygen demand tests were run. To anyone interested, an itemized list of laboratory equipment needed in a stream study laboratory was available upon request. Mr. Hoskins said that the practical aspect of such studies was that of determining the pollution assimilating powers of the stream from city to city, and, therefrom, the requisite degree of sewage or indutrial waste treatment. At present a study was under way on the Scioto River to reveal the effects of the new treatment plant reaching completion at Columbus.

A question was asked as to how long after sewage treatment is begun would it usually take to feel the full effect of treatment—reference being made to accumulated sludge depositions in the bed of streams. On the Scioto, a flashy stream, Mr. Hoskins believed a full year sufficient; on pooled streams possibly longer, but a full year should provide sufficient proof in most instances and a freshet or flood served a useful purpose in hastening the ultimate. In reply to another question as to costs, Mr. Hoskins' figures were again of magnitude. The cost of even the Scioto River survey reached approximately $1,000 per month.

"The Vitiating Influence of Acid Iron Wastes on Sewage Analyses," by CHAS. F. HAUCK, Chemist, Southerly Treatment Works, Cleveland, Ohio.

Mr. Hauck discussed the effects of pickling liquors (acid iron wastes) from steel mills, on chloride determinations. Failure of Standard Methods of Analyses to recognize such interference, due to the precipitation of the Chromate indicator used in the chloride titration, or to offer a method to overcome the trouble, was cited. As a result a method had had to be evolved for the laboratories of the Cleveland plant. The problem was met in two ways: (1) To 50 ml. samples 1 ml. of hydrogen peroxide is added and the sample warmed for 5 minutes. The precipitated ferric iron is then removed by filtration and the Standard Method of titration applied to the filtrate. (2) To 50 ml. samples, 2 to 3 ml. of standard chromate indicator is added and the precipitated iron chromate is removed by filtering before applying the standard titration test, adding more chromate indicator in case the residual after precipitation is insufficient.

Report on Sewage Filtration

A progress report, presented by M. W. TATLOCK, Chairman of Committee on Research, dealt with "Sewage Filtration." In commenting on developments in high rate aero-filtration the report directed attention to the results being secured in studies now under way for 18 months or longer on a small plant scale in Chicago; likewise, the studies under way at Dayton, O. Both pointed to the feasibility and reasonableness of high rate filtration. Regarding depths of stone beds, the upper 2½ feet of bed seemed to do essentially all of the work, and the matter of effective distribution seemed a more important factor than commonly conceived.

Mr. Tatlock, in reply to a question, said that the committee would study and report to the 1938 Conference meeting on mechanical as well as biological filtration.

Topical Discussions

Following past practice, the meeting broke up into four groups for the holding of "Topical Discussions" in separate rooms. The following morning, at the Conference breakfast, those presiding over the various meetings presented a summary of the remarks, discussion, questions and answers. The most fruitful was that on Activated Sludge, which seemed to attract the largest numbers and presented the greater number of problems.

1. H. W. Streeter, U.S.P.H.S. Sanitary Engr.; 2. E. C. Sargent, Sewer Commissioner, Lakewood; 3. E. E. Smith, Supt., Water and Sewerage, Lima; 4. Orville Lantz, Operator, Dayton; 5. Chas. F. Hauck, Chemist, Cleveland; 6. H. H. Mace, Barstow and Lefelbre Engrs., Cincinnati; 7. John Wahmhoff, Chief Operator, Delphos; 8. Clifford Cox, Pacific Flush Tank Co., Chicago.

Administration (H. N. Truax, Logan, Ohio)

The weakness in cost keeping records prompted a resolution requesting that a committee be appointed to devise uniform accounting procedure and record charts, in an attempt to secure adequate and comparable cost records on Ohio plants. In this the need for forms to fit the type of plant was emphasized.

Sewage Filtration (F. E. Harroun, Akron, Ohio)

Reporting for Mr. Harroun, H. H. Mace recounted experiences reported in filter ponding relief. The resting and drying out method (48 hours out of service) had proved helpful; but harrowing more so, no harm to the bed resulting therefrom. The absence of filter flies had been noted during the presence of acid iron wastes in sewages. With the cessation of iron waste the flies had returned. Bed flooding, where design permitted, continued to be the most effective means of fly control.

Digestion and Gas (W. E. Gerdel, Cleveland, Ohio)

Concerning quality of digester gas, as little as 0.01% hydrogen sulphide in the Cleveland gas had caused corrosion by the burned gas, deterioration of leathers in flame traps and sticking check-valves. Gas mains should be properly sloped and drained of condensed moisture daily, at least; in very cold weather more frequently. Provision had also had to be made to drain condensate from gas meters.

Activated Sludge (J. R. Collier, Elyria, Ohio)

In a praiseworthy report, Ben H. Barton presented a digest of the discussion on Activated Sludge practices.

Concerning the question—*What depth of sludge blanket should be maintained in final tanks?*—there were the usual "if" and "but" opinions. In general the deeper the blanket the better the effluent, but the danger lay in loss of oxygen, the onset of filamentous growths, and sludge bulking, when sludge is stored too long in final tanks before return to aeration units. The answer to the question might be one thing in winter and another in summer. Plants operating on the edge with regards to available air, and those on restricted input for most economical operation, had best maintain a shallow blanket to minimize sludge deterioration during the holding period in the final tanks. The best operating guide suggested seemed to be a watch on the sludge index and more rapid sludge recirculation when sludge density starts to decrease.

What routine tests should be made to maintain efficient operation? Of paramount importance, toward maintaining trouble free and economical operation, were the sludge index and dissolved oxygen tests—both made on catch samples from the outlet end of aeration units, and at points of expected minimum dissolved oxygen content in the aeration units. The all important point seemed to be maintenance of at least some dissolved oxygen at all points in the aeration units, except that it might disappear temporarily in the zone of minimum content during peak plant loading. E. E. SMITH, Supt. of Water and Sewerage, Lima, Ohio, stated that their experience had shown that a drop of dissolved oxygen in the *final* effluent to 50 per cent of saturation indicated onset of troubles, whereas 80 to 90 per cent saturation indicated smooth sailing. For most economical operation a careful watch on sludge index and attempting to hold dissolved oxygen somewhat above the 50 per cent figure was followed at Lima. Likewise the microscope was still used to detect onset of filamentous growths and trouble, unless resorting to mild chlorination of returned sludge which had served Lima so well in bulking control. (For the Lima method of chlorination for bulking control, see Mr. Smith's article in WATER WORKS AND SEWERAGE for October, 1935, pp. 362-364.)

RALPH J. BUSHEE, Engr., The Jeffrey Co. (formerly with the Chicago Sanitary District), reported the consistent use of the dissolved oxygen test as an indicator in air control at Chicago's plants. In addition, when nitrates dropped to 0.2 p.p.m. or thereabouts, trouble was indicated unless air was boosted.

The Effect of Iron on Activated Sludge

Concerning harmful effects from over-aeration, experiences revealed that such was a possibility. Such had been observed by Fred. Nelson (Dorr Co.), in connection with packing house waste treatment, where the sludge blanket went over-board. Interesting was the fact that there were no nitrates in the effluent. JIM COLLIER recited experiences wherein unloading of septic solids from sewers (due to a flushing program) had overloaded the Elyria plant, necessitating aerator bypassing for two days. Apparently the too long aeration of the sludge held in the system caused sludge peptization and turbid effluent for a day or so after the sewage was again turned into the aeration units. It had been prior practice to carry 3,000 to 4,000 p.p.m. sludge (dry solids) in the Elyria mixed liquor, applying 1 cu. ft./gal. excess air capacity for the purpose. The abundance of sludge had been looked upon as a barrier or buffer against plant upsets due to sudden loadings or partial sludge poisoning. With 20 p.p.m. iron in the crude sewage since January, 1937, chemical precipitation in the primary tanks had so reduced solids as to automatically drop the sludge content of the mixed liquor to 1,500 p.p.m. The net result was successful operation and good effluent with air economies. During the summer the iron waste was taken out of the sewers. Then came the onset of septic sewage and sewer flushing which proved too much for the plant, necessitating the two day bypassing to righten conditions. MILTON SPEIGEL (Chicago Pump Co.) reported similar summer experiences with flat sewers and septic sewage, necessitating systematic flushing at short intervals.

(1) W. E. Schlichte, Buckeye Products Co., Cincinnati; (2) S. S. McKinney, Supt. Sewerage, Kent; (3) S. P. Sotherland, Supt. Treatment, Mansfield; (4) R. F. Snyder, Supt. Treatment, Massillon; (5) Herbert Hansen, Supt. Treatment, Ravenna; (6) L. B. Barnes, Supt. Sewerage, Bowling Green; (7) E. A. Fischer, City Engr., Lakewood.

The Supernatant Liquor Problem

ROBERT ALLTON (Columbus), recalling that supernatant from sludge digesters created the same difficulty, facilities were being provided at the new Columbus plant to provide thickening of sludge input to digesters through centrifugal machines operating 24 hours per day. The end sought was to evenly load digesters and coincidentally reduce supernatant to a minimum volume. In fact, their plan was to get around the supernatant liquor problem by vacuum filtration of sludge and liquor combined, this being considered a likely solution because of the markedly reduced liquor input to the digesters. [Marked success with the scheme of sludge thickening ahead of digesters continues at Phoenix, Ariz. More recently the scheme has been adopted at Topeka, Kan. The centrifuging method at Columbus is decidedly new, as is the proposal to filter what would be supernatant along with the sludge.—ED.]

Chlorination for Bulking Control

E. E. SMITH, Supt. of the Lima plant, was asked to bring his experiences with chlorine for bulking control up to date. He told of attempts to limit the air and carry the minimum of sludge, to effect maximum operating economy. Operating thus, on the edge of air sufficiency, sludge bulking due to filamentous organism growths (sphærotilus mainly) had to be watched for and kept under control. When the microscope revealed such growths on the increase, chlorination of the returned sludge was started. The scheme had apparently been

first applied at Lima and continued to give the desired results, being utilized at intervals as the need was indicated.

The Chairman stated that chlorination had apparently not been successful at some other plants and requested L. H. ENSLOW to clarify the picture. This Mr. Enslow did by explaining that there was more than one cause of sludge bulking. In the case of Lima, Lancaster (Pa.), Hagerstown (Md.), Charlotte (N. C.), and elsewhere, the most prevalent form of bulking occurs—that being accompanied by sphaerotilus filaments and other indices of oxygen deficiency. The other form of socalled bulking was in reality peptization of flocs (failure to properly agglomerate and settle) which might be due to a sludge poisoning effect, such as had been produced by industrial wastes. Mr. Enslow said that the filamentous growths were an index of oxygen depletion in the aeration tanks; and, likely, more an indicator than a real cause of the bulking. In his opinion the *rate* of oxygen demand in the aerators was the all important factor to be dealt with in maintaining balance and economy of the process. Such rate could be controlled by reduction of (a) plant loading (sewage); (b) sludge return (also plant loading); (c) density of biological population in the aerators. The logical explanation of the effect of return sludge chlorination was the control of bio-activity, principally the speedy multiplying oxygen depleting saprophytic organisms, which in limited numbers were useful as protozoa food, but in excess robbed the useful organisms of their requisite supply of oxygen. These same organisms, being responsible for the oxygen robbing and degradation of fresh sewage to septic sewages, had been controlled by antiseptic (rather than sterilizing) dosages of chlorine to sewers. A mild chlorination of returned sludge would produce like effects, becoming slowly cumulative through the system but persistent. It was assumed that the chlorinated products produced (even milder than chloramines) were responsible for antiseptic effects. This, in turn, produced a flattening out of the oxygen demand curve in the inlet half of the aeration units, thus assisting the oxygen input to keep abreast or ahead of oxygen depletion. On this score, the efficiency with which the chlorine was distributed through the returned sludge seemed an important consideration, likewise the need for gradually increasing chlorine dosage, not alone for the sake of economy but to avoid over-shooting the mark. An over-dosage would be indicated by the peptization of floc and a resultant "milky" effluent.

Since a "bulky" sludge (large agglomerates) seemed to produce the highest results for the least air input, operators had been tempted to carry deep sludge blankets. Unfortunately, a small uppage in the plant loading at intervals proved too much for the procedure and resulted in genuine bulking, traceable to oxygen deficiency and the filamentous growths resultant from the latter condition. So, whether it be chlorination or another form of bacterial growth suppression, the scheme of control of bacterial population (particularly population turnover of the prolific soprohytes) seemed to be in the proper direction as a corrective in "balance-control" in activated sludge practices. At the same time, such a scheme should serve one or more of the following: (a) increased plant loadings; (b) higher volumes of returned sludge; (c) reduced air requirements in the aeration scheme; (d) greater production of solids (sludge) and less "wet-burning" of sludge to produce useless carbon dioxide and waste of energy in the aeration stage; (e) a slower reversal of oxidation effects within the sludge blanket in the final clarifiers. Seemingly the ideal system was to be that which most effectively flocculates and removes putrescibles in the form of value containing sludge. This, rather than the costly nitrifying and "wet-burning" end of the process. The answer would appear to reside in a possible control of biological balance and, therein, recirculating the ultimate minimum of returned sludge necessary to contribute the requisite "activation" seeding; and, more particularly, to serve the highly important role of flocculation and adsorption, productive of such high effects when measured in terms of power cost per unit of purification.

Mr. Enslow commented that experiments, involving the application of chlorine in minor dosages to the air entering the first half of the aeration units, might produce further evidence in the direction of bio-control possibilities during periods of maximum biological activity. Usually, such periods included those of maximum plant loadings and highest immediate oxygen demands by the sewage.

[It was announced at the close of the meeting that the 1938 meeting place would be Columbus.]

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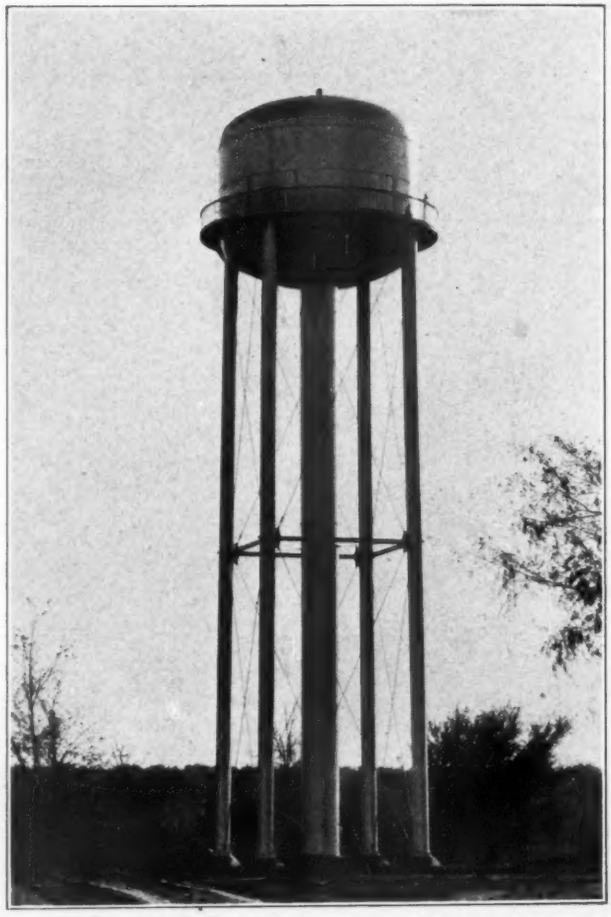
An Interesting Small Tank



(Photo—Courtesy Chicago Bridge & Iron Co.)

The above tank has recently been completed for the village of Parchment, Mich. It struck us as a nice example of symmetrical design, and somewhat unusual in appearance with its tubular columns, neat vertical bar hand rail, ellipsoidal bottom and roof, with the little "gazing-sphere" or air-plane warning light at the tip-top.

The tank holds 75,000 gals. and its bottom is 75 ft. above ground. But, how a man gets to the balcony is still a mystery to us.

Tonawanda's District 2 Plant. Chlorinator House on Left; Imhoff Tanks Between Glass Covered Beds and Two Chlorine Containers. Incinerator Beyond. (Note That the Plant Is Fenced in and Grounds Landscaped.)

EXPERIENCES IN THE CONTROL OF FOAMING*

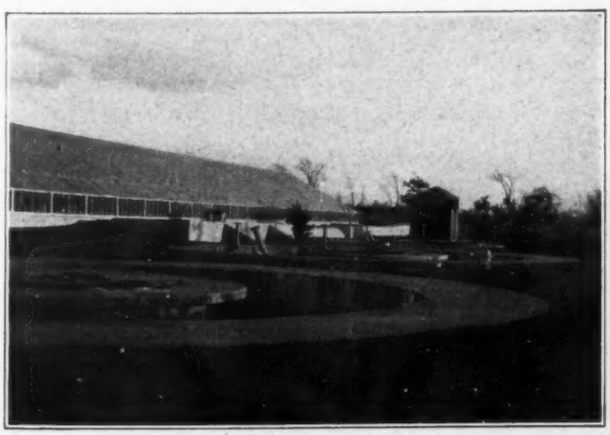
In Which the Advantages of Pre-Chlorination Were Evident

By CHANNEL SAMSON

Supt. of Plants,
Department of Sewers.
Town of Tonawanda, N. Y.

DISTRICT No. 2 Sewage Treatment Plant, in the Town of Tonawanda, N. Y., serves the Village of Kenmore, providing primary treatment of the sewage. Treatment is provided by four circular Imhoff tanks with a combined capacity of 5,000 to 6,000 persons on the basis of 100 gallons per capita per day. The inlet is on one side, and the flow divides to pass half around the tank where it is collected in an effluent trough. Sludge is pumped from the lower compartments to glass covered sludge beds for nuisanceless drying. The effluent, since 1933, has been chlorinated by using a manual feed chlorinator with a capacity of 300 lbs. per twenty-four hours. Up to recently, and for several years prior, there has been considerable difficulty from tank foaming.

*This article was prepared for publication in "Water Works and Sewerage." The author has since included some of its context in a paper presented by him before the New York Sewage Works Association.—Ed.



Close-Up of One Imhoff Tank. At the Screen House Beyond Pre-Chlorinating Dosage Is Applied.

Pre-Chlorination Tried

During one of these foaming spells, prechlorination was tried, a portable machine being used, to introduce chlorine into the influent channel at the rate of 80 lbs. per twenty-four hours. The dry weather flow then was about 1,400,000 gallons per day and resulted in an average chlorine dosage of roughly 60 lbs. per mg. Use of pre-chlorination for about three weeks improved the condition of the tanks. The pH increased to approximately 7.0.

This work was done in connection with a report and recommendations made by Nussbaumer & Clarke, Inc., Consulting Engineers, of Buffalo, concerning improvements which could be made to the plant. Durnig the past year, a number of their recommendations have been put into effect by constructing the suggested improvements.

A second proportional feed chlorinator has since been installed which applies chlorine to the plant effluent in proportion to the flow. The original chlorinator is now used for pre-chlorination of the crude sewage, application being made into the influent channel to the screen chamber.

Water to operate the chlorinators was formerly purchased from a private water company, and was a considerable item of expense. To reduce this cost, a small pressure-tank water system was installed. In place of water, the pump takes its suction from the settled sewage conduit. This procedure has been satisfactory and has resulted in substantial savings in the cost of water to operate the plant.

The year 1935 was the last full year during which the plant was operated with post-chlorination alone. In that year, 92,800 lbs. of chlorine were used to treat 863 million gallons of sewage. This is an average of 107.5 lbs. per million gallons required to produce a positive chlorine residual in chlorinating only the settled sewage.

The Laboratory, Located on One End of the Chlorinator House. Note Automatic Chlorinator for Effluent; Manual Chlorinator for Pre-Chlorination; in the Foreground, Ton Chlorine Containers.

During the first five months of 1936, post-chlorination was continued at the following average rates:

Month	*Cl. Lbs./M.G.*
January	101
February	105
March	51.36*
April	83.20*
May	151.00

*Rate reduced on account of large amounts of infiltration and storm flow.

Routine Pre-Chlorination Started

Beginning in May, both post and pre-chlorination were employed, and a much better condition in the Imhoff tanks could be observed. In fact, there has been no actual foaming condition which has given trouble from that time till the present. In addition, it has been possible to increase the sludge depth in the tanks from about 10 to 11 ft. deep to 12 to 13 ft. deep without trouble or rising of sludge through the slots. Sludge has always dried well on the sludge beds, and pre-chlorination does not seem to have affected the drying one way or the other.

During the latter part of 1936, the average rates of chlorination were as follows:

Pre-chlorination	32.3 lbs. per M.G.
Post-chlorination	72.8 lbs. per M.G.
Total	105.1 lbs. per M.G.

Chlorine Less as Conditions Improved

During 1937, with the Imhoff tanks in better condition, it was possible to lower the chlorination rates and still secure the required residual. The average rates so far this year are:

Pre-chlorination	29.4 lbs. per M.G.
Post-chlorination	64.0 lbs. per M.G.
Total	93.4 lbs. per M.G.

This compares with an average of 107.5 lbs. of chlorine per M.G. in 1935 when only post-chlorination was used. The saving of 14.1 lbs. per M.G. is attributed to the more economical dosing by the proportional feed chlorinator and also by the decreased demand of the settled sewage from better functioning tanks. For the year, the saving is estimated at $565.00. Pre-chlorination is practiced from April until October. It is not required during the winter months.

The better conditions in the Imhoff tanks are indicated from the following table of pH values:

pH MONTHLY AVERAGE FOR FOUR IMHOFF TANKS

	1935	1936	1937
January	6.75	8.8	7.13
February	...	...	7.05
March	6.75	6.87	7.0
April	6.55	6.91	6.6†
May	6.97	7.03	7.1
June	7.04	*6.95	7.0
July	6.87	6.91	6.9
August	6.81	6.67	6.8
September	6.72	6.91	...
October	6.68	6.91	...
November	6.5	6.81	...
December	6.74	6.87	...

The district has recently purchased and installed a small laboratory, so that in the future data on B.O.D., suspended solids, and other needed tests can be performed and more complete information secured.

*Pre-chlorination begun.
†Based on one test for month when trouble was indicated. However, foaming did not develop even though the pit test indicated trouble to be expected.

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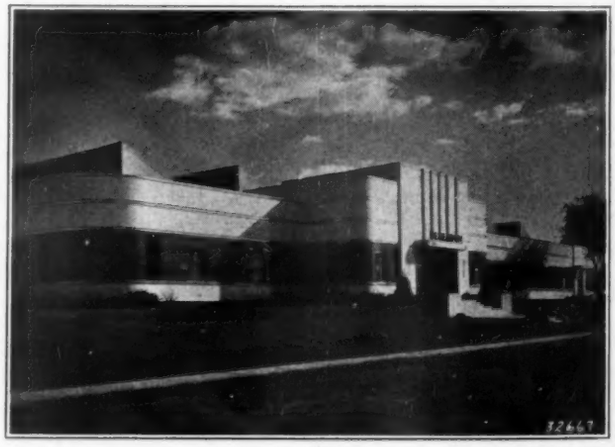
"Armco's House of Research"

On November 5th, 200 scientists from all parts of the country were guests of the American Rolling Mill Co., at the official dedication of Armco's modern and colorful research laboratories in Middletown, Ohio. At the banquet, concluding the day's activities, Chas. F. Kettering, General Motor's renowned vice-president in charge of research, as guest speaker, sounded the note that "Research is what keeps industry healthily dissatisfied with itself." Other speakers were Geo. M. Verity, Chairman of Armco's board, and Chas. R. Hook, Armco's president. Dr. Anson Hayes, Armco's director of research was toastmaster.

The colorful but harmonious exterior construction of enameled iron with stainless steel trim, and glass block



Armco's Research Laboratories, Middletown, Ohio

center band, at a distance gives the effect of silver-striped ribbons of yellow satin which borders a band of crystal beading, interspersed with panels of black jet.

The new building typifies modern industrial design, involving sheet iron and steel in its application to construction. Being of welded all-steel frame and wall construction, not a rivet was driven and the fabrication itself served as a research project while taking form as a research structure, providing 43,500 sq. ft. area to house 12 laboratories, looking to improvements to existing Armco products, and seeking new ones.

WHAT COST LEAKING MANHOLES?

Answered in a Study of Storm Water Entry Through Manhole Covers—Good and Bad

By A. M. RAWN*

Associate Editor, Los Angeles, California

IN A.S.C.E. Manual of Engineering Practice, No. 2, the same being entitled "Definition of Terms Used in Sewerage and Sewage Disposal Practice," a "separate system" is defined as: "a system of sewers in which sewage and storm water are carried in separate conduits."

Presuming a strict interpretation of this definition, it is doubted that a "separate system" as related to the "sewage" conduits has ever been built, although many have been attempted.

It is comparatively easy to keep domestic sewage and industrial wastes out of storm sewers but to achieve the reverse of this operation during storms of even moderate intensity is far more difficult, if not impossible. It is doubtful if any operator can state with certainty that rain storms have no effect upon the quantity of flow in the "separate" sewage conduits under his supervision.

Analysis of separate systems indicate that there are, in general, two reasons why rain storms increase the flow in separate sewage conduits. One reason—there are down spouts illegally or otherwise connected to the sewers; another—leaking manhole covers allow water entry during street runoff. In an effort to tie the thing down to some quantitative analysis, a test of manhole cover leakage was conducted by the Los Angeles County Sanitation Districts, and yielded some rather illuminating results. In fact, the findings indicate that considerable care in the design of the manhole cover, or some form of protection against infiltration at the point, would yield large dividends in decreased flow during rains.

One has only to operate a sewage treatment plant, constructed to care for the designed flow from a separate system, during a rainy season, or attempt the operation of a low lying pumping station built for like purpose, to recognize the difficulties presented by periodic flows two or three times the maximum dry weather rates, and the importance of shutting out storm waters. Based on such consideration, it is the writer's belief that information which throws definite light upon a source of trouble may be of assistance in helping to correct the difficulty.

Leakage Tests

To conduct the test a short section of the upper part of a standard brick manhole was built and equipped as in standard practice with a manhole frame and cover. Three different frame and cover assemblies were tested in turn:

No. 1: A new standard, non-locking type in common use, in which the cover seats directly upon the cast iron offset in the frame and maintains its position solely because of its weight. There was a single pick hole in the cover and a notch in the rim for raising.

No. 2: A similar assembly which, having been in use a number of years, was quite badly rusted both as to cover and frame. The same single pick hole and notch.

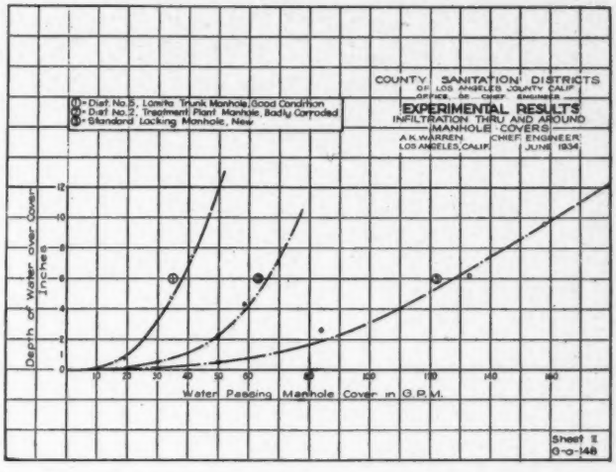
No. 3: A standard locking, non-rocking frame and cover. One in which the cover is placed on the frame and rotated horizontally a little to permit offset dogs in the cover to engage in grooves in the frame and hold the cover securely in place. There are three small pick holes in this cover.

A shallow brick well was extended upward around the cover opening so as to permit measurement of leakage through the cover at different depths of water over it.

It merely remained to measure the water depth over the cover and the repletion required to maintain such depth in order to determine the cover leakage for different conditions. Measurement of repletion was over an adjacent "V" notch weir. All water levels were observed in connecting "U" tubes.

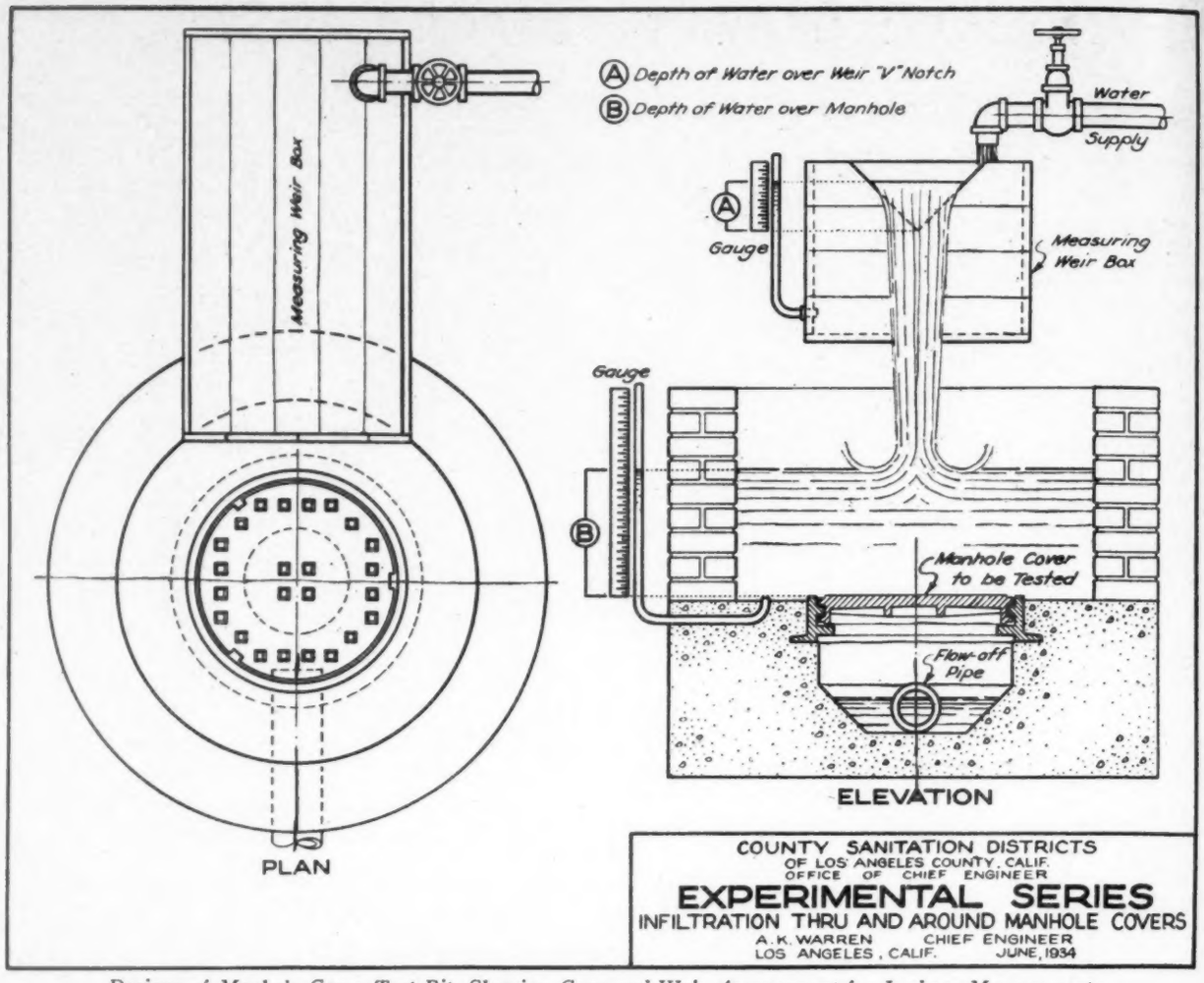
The accompanying chart reveals the results of the test, showing the leakage in gallons per minute through and around each of the three covers for water depths, 0 to 12 inches, over the cover. The value of a good contact between the cover and supporting ring is clearly illustrated in Curves 1 and 2. The price paid (in excess storm flow) for the extra holes and lack of full contact between the cover and rim in the locking type, is illustrated by a comparison of Curves 1 and 3.

It is not at all unusual for low lying or flat urban areas to have slow storm runoff. In such areas close attention may well be paid to the selection of type and "fit" of the manhole covers. Specifying and securing a design that will function to hold leakage to a low minimum, should merit especial consideration. As an illustration: When locating manholes at an average interval of 300 feet there are 17½ manholes per mile of sewer line. In an average single family residential dis-


COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY CALIF.
OFFICE OF CHIEF ENGINEER
EXPERIMENTAL RESULTS
INFILTRATION THRU AND AROUND
MANHOLE COVERS
A.K. WARREN CHIEF ENGINEER
LOS ANGELES, CALIF. JUNE 1934
① - Dist. No. 5, Lomita Trunk Manhole, Good Condition
② - Dist. No. 2, Treatment Plant Manhole, Badly Corroded
③ - Standard Locking Manhole, New
Depth of Water over Cover Inches
Water Passing Manhole Cover in G.P.M.
Sheet 1
0-a-148

Volumes Passing Through and Around Manhole Covers. Various Designs.

*Asst. Chief Engr., Los Angeles County Sanitation Districts.



Designs of Manhole Cover Test-Pit, Showing Gage and Weir Arrangement for Leakage Measurements.

trict, a mile of sewer may take the sewage flow from some 600 individuals, about 50,000 gallons per day. If the street drainage is such that during a rain storm, water stands at 1 inch depth over the manholes during one hour, the flow in the sewer in the case of manhole cover No. 3 will be more than doubled. Inadequate storm drainage or continued rain may cause this increase to be many times greater, even to the extent of taxing the carrying capacity of the line in extreme instances.

Downspout connections to sanitary sewers are usually prohibited; however, there is always the suspicion that there are some and that they contribute to excess flow during storms. That they are relatively unimportant, unless quite extensive, may be illustrated by the following observation. The entire (100 pct.) runoff from an ordinary city block (300 x 300 ft.) during a one-inch rain will not contribute as much water to the sewer as 17½ manhole covers of Type 3 under one inch of water for one hour.

When seeing water *apparently* standing over or flowing across a manhole lid, the quantity that the observer *does not see* dropping through it may be astonishingly large, if not embarrassingly so, in the eyes of the sewer designer or operator.

▼

Denver's New Filter Plant Dedicated

The new Moffat Filter Plant for Denver has been completed. The above picture shows the dedication exercises held on the filter operating floor. In the center foreground (side view) is seen Col. Herbert S. Crocker, Consulting Engineer for the Denver Water Board.

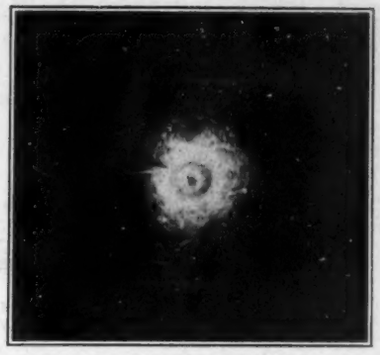
This plant (capacity 50 M.G.D.), is the fifth filter plant constructed for Denver. It will treat water from the Frasier River, brought from west of the Continental Divide through Moffat Tunnel under the Rocky Mountains. With the opening of this plant lawn-sprinkling restrictions in Denver are being removed.

The plant has been effectively described in some detail in an article in the December, 1936, issue of the Journal of A.W.W.A. by Lewis R. Howson of the firm Alvord, Burdick and Howson, Chicago, who designed and supervised construction of the plant.

Dedication Exercises—Denver's New Moffat Filter Plant

OLD DOMINION SECTION OF A. W. W. A.

Meets in Capital of Confederacy



"The Light That Never Fails"—(It's Submerged Under 18 Ft. of Filtered Water at Richmond's Plant)

RETURNING to Richmond, the place of its organization as the Virginia Water and Sewage Works Association, the Virginia Section of the American Water Works Association, on November 4 and 5, held another praiseworthy and enjoyable meeting. The official registration was 213, of which 190 were men, the balance representing a portion of the ladies attending.

Close to 300 were present at the dinner-dance, at which Richmond's long time mayor, Dr. J. Fulmer Bright, gave the principal address featuring the notable history behind old and modern Richmond and its water works.

The forenoon of the first day was given over to the golf tournament; the afternoon of the second day to conducted tours through one of Richmond's largest cigarette factories and to points of historic interest, of which there are many in this city of prominence in Colonial America and, later, the capital of the Confederacy. To nearby Williamsburg, now restored to its pre-revolutionary splendor as the seat of Virginia's British Colonial governors, many visitors went after the meeting.

As a closing activity, many members and guests visited Richmond's filtration plant, to inspect the several features, innovations and processes for which it has become widely known as "The Filtration Plant of Today."

For the success of the Richmond meeting, major credit and a vote of thanks went to Marsden C. Smith, Engr. of Water, and National Director of A. W. W. A.; to Richard Messer, Chief Engr., Va. Dept. of Health; to Mrs. Richard Messer, as Chairman of the Ladies Entertainment Committee; to Neptune's "Mike" Seibert, of Richmond, who had charge of the Golf Tournament.

Officers Named

In the brief business session at the close of the meeting, the following were presented by the nominating committee as officers for the ensuing year. The vote was unanimous.

A. L. Meisel, Town Mgr. (Williamsburg), Retiring Chairman.

Hugh B. Rice, Supt. of Works (Lexington), New Chairman.

Chairman—Hugh B. Rice, Supt. of Works, Lexington.

Vice-Chairman—Howard A. Johnson, Supt. of Filtration, Danville.

Secretary—H. W. Snidow, State Dept. of Health, Richmond.

Treasurer—E. C. Meredith, State Dept. of Health, Richmond.

Executive Committee—S. L. Williamson, Charlottesville; C. L. Crockett, Roanoke. (Marsden C. Smith became Virginia's representative on the Board of Direction of A. W. W. A. on June 7, 1937, as successor to President Dugger.)

Mr. Whitfield and the President

The meeting was opened with a brief "Welcome" from George H. Whitfield, Richmond's genial Director of Utilities, who showed some of the best color-movies that it has been this writer's privilege to see. One movie took the audience on a tour of Richmond's beauty spots, and to public buildings and points of historic significance and interest. The other was a vivid movie, both educational and spectacular, of the course of Richmond's supply of water; from the muddy James, red with the clay of Piedmont Virginia, through the churning flocculators and quiet basins; to the rainbowed sprays of the filtered water aerators; to the sky-blue of the clear-water reservoirs. Added interest came from the fact that this movie was made by George Morrissette, amateur photographer in the Water Department.

Then followed a brief address by Virginia's President of A. W. W. A.—E. F. Dugger—just back home from a tour of section meetings from coast to coast. Mr. Dugger's talk followed very closely those made before other section meetings, and largely covered in previous issues. In recounting membership growth in A. W. W. A., he had 50 more members to add, making the total gain since January 1, 1937, 500 members, representing a record for all time. He announced that a President's Award was to be made by himself to that section showing the greatest member gain during the year ending with the 1938 A. W. W. A. Convention. Existing awards covered greatest percentage increase in membership of section but an award for that section showing the greatest total gain being lacking, he expected to supply such. This was in order that those sections with larger membership might have an equal chance at winning an award as had the smaller sections, the latter finding it easier to show greater percentage gains.

Technical Sessions

"Physiological Aspects of Potable Water Supply," by DR. SIDNEY I. NEGUS, Medical College of Virginia, Richmond, Va.

H. A. Johnson, Supt. Filtration (Danville), Made Vice-Chairman.

E. C. Meridith (Va. Dept. of Health), Re-elected Treasurer.

This, the opening paper, proved of marked interest and will prove interesting reading to many a water purification man. Dr. Negus literally tore apart the existing specifications of suggested upper limits in respect to certain metals and limitations on caustic alkalinity in waters supplied the public. In referring to Appendix 4 of the U. S. Treasury Department's (U. S. P. H. S., June, 1925), suggesting limits of metals, etc., in drinking waters, he said that these were overly safe—in fact, had been derived from a scientifically shabby background. Understanding that their revision was planned, Dr. Negus went on to point out some of the more unsupportable specifications. Concerning copper, 0.2 p.p.m. was the upper limit, whereas the human body had been shown to demand 2 m.g.m. per day for continued health. For the limits on aluminum and arsenic there was no proof of their injuriousness, and arsenic was not unknown as a diet for some beautiful ladies. As to hardness, there was no possible evidence of any upper limit. On the contrary, operators adding lime were performing a favor to many consumers needful of lime in the diet. The warning against "caustic alkalinity" (free hydroxides) in potable waters, sounded ridiculous in the face of no evidnece of injury where caustic water had been served consumers for 16 years. Objection to caustic water could not be substantiated except in amounts objectionable to consumers' palates. As to iron, the 0.3 p.p.m. limit applied possibly to laundry and industrial waters but certainly was not of physiological significance. The same comment applied to manganese limits. Sulfates, iodine, chlorine and chloramine he dismissed as of no consequence.

Now when it came to a few elements likely to be found in potable waters there seemed ample grounds for limiting them. Fluorides, for instance, had been shown to attack teeth when much above 1 p.p.m. in terms of fluorine. Selenium had been shown ten times as toxic as arsenic; in water had been known to kill cattle. As to the 5 p.p.m. upper limit for zinc (Zn), there may be some grounds depending upon which salt of the metal was present. It was known that 500 p.p.m. of zinc added to water as sulphate of zinc had not hurt rats. On the other hand, 8 p.p.m. in drinking water had been reported to intestinally upset consumers but, on the other hand, chemists of zinc companies claimed 40 p.p.m. non-injurious.

Coming to the most important element, lead, he reviewed the effects of lead on the system and the fact that the poisoning was due to failure of the body to throw off lead and, therefore, such cumulative effect justified the upper limit of 0.1 p.p.m. lead. Dr. Negus warned against lead lined pipe or lead services, unless the water was first proven non-aggressive to lead. He reported a case where water standing in lead service pipe had picked up 1.44 p.p.m. of lead in 10 days.

W. W. BRUSH (New York) reported a case of zinc poisoning at a picnic where lemonade was served in galvanized buckets.

R. C. BARDWELL (Richmond) said that any boy who had helped make pink lemonade in galvanized tubs when the circus came to town, would wonder about zinc-lemonade being harmful. Mr. Bardwell was highly pleased to see the caution against caustic water being exploded, because there was ample proof that it had not been injurious; besides, was usually a very safe water pathogenically.

From Sweet Briar Came Supt. J. R. Abbitt; from Orange Came Town Mgr. R. Blankenship—to See Richmond's Filtration Plant of "Today." On the Right—H. E. Lardley, Plant Supt. and P. W. Blankenship, Assistant.

PROF. F. H. FISH (V. P. I.—Blacksburg) told of complaints of milky water traced to 20 p.p.m. zinc dissolved from new galvanized pipes. He wondered why galvanize pipes, if the zinc wouldn't stay on.

L. H. ENSLOW (New York), in complimenting Dr. Negus, said that the copper "bugaboo" certainly should be exploded. He cited the fact that it had been shown that copper in quantities to cause trouble would so pucker the consumer's mouth as to give ample warning. It was fairly well established that 5 p.p.m. copper was non-injurious. Concerning zinc, he had reason to believe that a form of diarrhea was produced by water containing zinc from new pipes, and cited a case of such trouble in an army camp supplied water through new galvanized pipes, for a good part laid on ground surface in the sun. With "aging" of the pipes the trouble cleared up, along with the high zinc content. That was before the days when pH adjustment of waters came into use for reducing their aggressivity. Like Dr. Negus, he had much respect for lead in any amount, and had learned from experience how much lead some waters would dissolve while standing only over night in lead service pipes. It would be a wise precaution to consider lead services potentially hazardous and run water to waste every morning if the premise was served through lead service pipes—i. e., unless it could be shown that the particular water was not aggressive to lead.

RICHARD MESSER (Richmond) said that some of the deep wells in tide-water Virginia had fluoride contents

Marsden Smith, Engr. of Water (Richmond), Host and Master of Ceremonies.

M. J. Seibert, Neptune Meter Co. (Richmond), Had Charge of Golf Tournament.

1. H. F. Lucas, Commissioner and R. L. Reynolds, Town Mgr. of Luray, Va.; 2. Veteran Mayor Geo. W. Wesson and Supt. H. W. Hayes of Lawrenceville; 3. Marsden Smith, Pointing Out Something-or-Other During the Filter Plant Inspection; 4. A. T. Lundberg, Chief Engr., County Water Dept. and R. M. Wirt, San. Engr., Arlington, Va.; 5. In This Case "W-W" Doesn't Stand for Water Works—It's Wm. Welch and Col. "Jo" Wrench of "Nuchar" Fame. (No Charge for the "Plug" Colonel.)

above 1 part per million. While there were known methods for fluoride removal, unfortunately, they were far from economical.

"Keeping Good Water Good," by LINN H. ENSLOW, Editor, WATER WORKS AND SEWERAGE, New York City.

Mr. Enslow's informal discussion covered two phases of keeping good water good. The first part dealt with naturally good waters and the cost to municipalities, which industrial pollution had entailed, in returning once good water to a state of purity, wholesomeness, appearance and palatability as nearly to its original "goodness" as was practicable. Also he referred to problems arising in connection with impounding and raw water storage reservoirs in which degradation due to algae, shallow marginal growths, organic decay, deoxygenation, aneorobic breakdown, solution of iron and manganese; followed by reservoir turnover, with the foul tastes and odors, iron and manganese troubles ensuing. The first condition constituted an imposition by industry and it seemed that municipal and state authorities needed a "lifting" Federal hand in getting water supply streams cleared up, as well as other water-ways.

No further removed than Richmond's James River at the foot of the hill, was an example of up stream pollution which added many dollars to the cost of water purification and in low river stages created conditions, at times, with which the most expert operation with modern facilities could not produce a product wholly deserving of the designation "good." In the case of impounded water now advocated by some for Richmond, from a far removed mountain watershed at staggering costs, the citizens, ready to pay anything for a safe and pleasing supply of water, might be sadly disillusioned during the years required for such reservoirs to complete their cycle of natural purging by aging. Then after nature reached its balance the matter of keeping good water good by maintaining water shed patrols, keeping the shore and weed line clean, repeated systematic coppering for effective algae control, and water treatment to preclude supply main growths, decaying slime deposits, or main corrosion, were more items to consider in keeping good water good. After all, it seemed that the ideal surface supply would be a stream with a free flow of at least fairly good water, with which modern purification methods could deal. This, with a reasonable factor of assurance that drastic and overly expensive purification methods become a non-necessity by effective regulation (not prohibition) of stream usage at points above the taker.

It was Mr. Enslow's opinion that water purification experts had probably done a disservice in developing measures touted as capable of dealing with pollution loadings in excess of reasonableness. The result has been a debilitated effort at pollution control; and an ever-growing pollution loading of water-supply streams, mainly because water purification men have been too proud to say that they "couldn't take it." Water supply should be reasonably clean as well as absolutely safe. And it was only logical to insist that polluters do their share in seeing that water purification plants receive a raw product which may be completely cleaned with "ivory soap" methods, instead of "steel-wool and dutch-cleanser" methods, which at best usually can not produce a finished water without some deficiencies in one or another direction. Taking into account self purification of streams domestic sewage, at points only a reasonable distance below its point of origin, was on the whole to be compared with industrial waste pollution as being but a "lily in the garlic patch." It seemed to Mr. Enslow that there had been some "gnat straining," in providing sewage treatment works for water supply protection, while stream conservationists and health authorities have let the industrial waste "camel" be swallowed too long for present day comfort of industries, authorities, and Mr. John Q. Public, who wants unblemished, pure mountain water, spring or well water, at any cost.

The second part of Mr. Enslow's talk was devoted to keeping good water good in the local system—assuming it to be sufficiently good at the source of supply, or made thoroughly so by effective purification methods. Needless to say, "good housekeeping" was one of the first requisites and he illustrated cases of assumedly tight covered reservoirs and clear wells which upon inspection had revealed the carcasses or skeletons of small animals or birds. He touched on the hazards of cross connections on the distribution system and the question of localized pollution from back-syphonage of toilet and other fixtures, drain sumps or worse into the system in case of vacuum due to main breaks or equivalent. He told how good sparkling waters became poor, murky and staining waters in consumers' pipes, due to aggressiveness, and because of corrosion with zinc or iron pick-up. He outlined the present day understanding of the cause and correction of main tuberculation, household service corrosion, and resultant "dirty" water which left the plant as clean water. To determine the correct quantity of hardening to apply to such waters, in the form of

D. R. Taylor, Supt. (Roanoke Water Co.) (Has a Meter Recorder That Tells When Aunt Susie Washes Her False Teeth.)

Alan A. Wood, Sales Engr., Builders Iron Foundry. (If He Could Meter His Smile as Successfully as Other Things He Could Retire.)

Programmers

Carl J. Lauter, Chief Chemist, Water Div., Washington, D. C.; Linn H. Enslow, Editor, "Water Works and Sewerage," New York; Chas. E. Coleman, Engr., De Laval Turbine Co., Trenton, N. J.

lime treatment, the marble solubility test was generally employed, but after all, it took nothing more than a "wire nail chemist" to determine the adequate treatment. Water treated so as to rust already slightly rusted (and cleaned) wire nails least, when submerged in closed jars or bottles filled *full* of the water, was that water least corrosive to iron and steel pipes. By such simple observations on cold and hot water the practical answer to the correct lime dosage could be determined by expert and novice alike. This "horse-sense" idea, born in a Virginia plant, deserved commendation and had been responsible for an editorial on "Wire Nail Chemists."

away the "sins" of several years' accumulation. The "Chloramination" scheme for dead end troubles had been proven effective, possibly first at Richmond, and since at many points where given a thorough trial. The method would likely prove of practically universal benefit in time—i.e., provided mains too dirty be cleaned first and the treatment be allowed a reasonable time to penetrate throughout the system.

So—to "Keep good water good" the basic steps are:

(1) Clean the water as effectively as practice permits at the plant.
(2) Harden it with lime to produce minimum corrosion, without over-treatment resulting in deposits of carbonate in meters and hot water lines; or, zinc lead and brass attack; or, sudden sloughing off of tubercules, as some had noted with very soft waters.
(3) Clean the mains if necessary before commencing (2) or (4).
(4) Practice "Chloramination" to maintain aseptic conditions in sluggish flow sections of the system, thereby checking corrosion and water degradation traceable to pipe slime, fermentation and decay, which lime treatment alone will not accomplish.

Leading the discussion, RICHARD MESSER, ex-boss of Mr. Enslow, made some complimentary remarks in appreciation of the contributions and observations of Mr. Enslow, based on wide experience.

I. M. GLACE (Consulting Engr., Harrisburg, Pa.) recited experiences with lime treatment of a very soft

1. "Jo" Gilbert, Sales Engr., Link Belt Co., Philadelphia; 2. G. R. Johnson, Vice Pres., Lynchburg Foundry Co., Lynchburg; 3. W. H. Fawcett, City Engr. and Supt. Water, Bristol, Va.; 4. Geo. R. Elder, Supt. Utilities, Radford, Va.; 5. S. L. Grant, Supt. Water and Sewage, Winchester, Va.; 6. R. W. Catlin, Town Mgr., Farmville, Va.; 7. Charlie Gregg, Sales Engr., S. R. Dresser Mfg. Co., Bradford, Pa.; 8. R. C. Clement, Distr. Mgr., Wallace and Tiernan Co., Washington.

Then Mr Enslow came to a common "ailment"—dead end troubles—involving fermentation of deposits, productive of carbon dioxide, pH drop, and corrosion. Finally the organic matter degradation in warm weather reached the oxygen depletion stage; then sulphate breakdown, by the common (non-pathogenic) organisms of putrefaction, and the resultant bad tastes and odors, indicated by the black water observed during summer and fall hydrant flushings. In this, the gradual accumulation of putrescible organic matter depositing on the interior of all sluggish flow mains, the roughness (tuberculation) of mains had an important bearing. To appreciate this it was only necessary to smell the material from low draught mains removed by the cleaning scraper (go-devil) or by heating and finally burning some of the "muck." That such could possibly come from good water would hardly seem possible, but it was a fact that contact with interior main surfaces would cause organic matter to deposit which even good coagulation and rapid filters are not capable of removing. The question of correcting water deterioration in mains resolved itself into maintaining almost, if not absolute, sterile conditions throughout. Realizing that the trouble is not evident in winter, led to attempts at suppressed bio-activity through the use of ammonia and chlorine treatment to take residual chlorine to the far reaches of the dirtiest part of the system—the dead ends. Sometimes interior conditions are such that main cleaning is necessary to wash water which had resulted in softening and disintegration of rust tubercules. Concerning Mr. Enslow's "Wire Nail Chemists," he had recently seen a "Corrosion-Detector" for inserting in water mains. It made use of the principle of rusting of wire nails. Another "detector" was a soapy cloth, left overnight under a slow dripping faucet, on which the size of iron spot was the semi-quantitative yard-stick.

J. W. ENGLE (Chemist, War Dept., Arlington, Va.), after a main repair job, had located the remains of a white woolly dog as the cause of consumer complaints.

C. L. Crockett, Chemist, Norfolk and Western Ry., Roanoke, Va. (Elected to Executive Committee.)

Roland Leveque, Supt. Filtration, Fredericksburg, Va. (Enslow's "Wire-Nail Chemist.")

Engineers

Reeves J. Newsome, Consulting Engr., New York (Director of A.W.W.A.—N. Y. Section); R. C. Bardwell, Water Engr., C. & O. Ry.—Richmond; Martin Johnson, Wiley and Wilson Engrs., Lynchburg (To His Credit the Novel "Cathedral" Filter Plant of Lexington, Va.).

The need for "good housekeeping," a thorough clean-up and disinfection after repair jobs was stressed by this experience.

ROLAND LEVEQUE (Supt. Filtration, Fredericksburg, Va.), admitting that he was Mr. Enslow's "Wire Nail Chemist," said that he realized that publicity was good for water works men, but it had cost him considerable extra work since he had been "discovered" in Fredericksburg. Called on to test water samples and suggest treatment in two counties, he had proved to be a star salesman (without compensation) for H.T.H. hypochlorite, sold through a local laundry.

Three of the pumps, requiring 12,000 H.P. motors, will be the largest in America. Originally an 88 per cent efficiency was the specification demand, whereas the contractor's model pump upon tests gave an efficiency of 91.5 per cent. Thus a new record for centrifugal efficiency has been established, illustrating the potentialities of special design, the cost of which might yield handsome returns.

"What Is New in Distribution" (Part I), by C. A. MCGINNIS, General Manager, Transite Pipe Division, Johns Manville Co., New York City; (Part II), by W. P. Cox, General Sales Manager, McWane Cast Iron Pipe Co., Birmingham, Ala.

MR. MCGINNIS devoted his time to showing movies of important and unusual installations of "Transite" asbestos-cement pipes, and special adaptations of various jointing methods and fittings. Construction over trestle, highway and railroad bridges was shown, also the advantage of flexible couplings on fire hydrants branches, construction in tunnel, through marsh lands, method of tapping and jointing.

MR. COX said that while cast iron pipe was anything but new, there had been some improvements in the product in recent years. Mechanical casting improvements had contributed higher uniformity and better qualities to the metal. Also better raw materials (pig iron, etc.) had been demanded by pipe producers; more scientific control of the cupola, mold production and pouring. In mold making the use of processed sand had proved an

1. M. R. Mills, Pres., Va. Equipment and Supply Co., Richmond; 2. R. D. Wright, Asst. Engr., Lynchburg Water Dept.; 3. "Jo" Millikin, Chemist, Roanoke Water Co.; 4. Wm. S. Flynn, Sales Engr., Eddy Valve Co., Waterford, N. Y.; 5. W. B. Cambridge, Hersey Meter Co., New York City; 6. Walter Schaeffer, Sales Engr., Rensselaer Valve Co., New York City; 7. W. W. Winfree, Asst. to V. P., Glamorgan Pipe and Foundry Co., Lynchburg; 8. J. M. Pharr, Supt. Filtr., Newport News Water Co., Denbigh, Va.

What's New, in This and That

What might be designated as "Peddler's Hour" constituted a group of informative brief reviews of "What's New" in this and that field, presented by six manufacturers' representatives.

"What Is New in Pumping," by C. E. COLEMAN, Engr., DeLaval Steam Turbine Company, Trenton, N. J.

Mr. Coleman said that during the past 5 years there was little new in centrifugal pumps, the efficiency of which had been brought to the top between 5 and 8 years ago for stock designs and sizes. Frequently pumps could be made more efficient for a specific installation, if time were allowed bidders for making special design and fabricating; but the additional cost would seem prohibitive unless there were sizeable power savings to be had. Manufacturers had to strike a happy medium in the number of casings for a given size pump (5 for a 12-in. size, for example) and then fit the proper impeller to one of the 5 casings to give the nearest approach to a special design for governing head and capacity requirements. For very large installations, special design might pay handsomely. He cited the studies made to attain maximum efficiency to 1/10th per cent on the Los Angeles Aqueduct installation, where every 1 per cent efficiency increase meant $50,000 per year in power saved.

all-important contribution. In the pipe shop continuous laboratory testing and inspection had proved one of the best investments made—now 1 out of every 6 men being an inspector. Today's cast iron pipe was produced with only one-half former tolerances in wall thickness; testing pressures had almost doubled; transverse (beam) and tensile strengths had been increased 50 per cent, to stand rough treatment and trench strain.

Concerning joints, Mr. Cox referred to the new precast lead joint and the quickly and tightly made rubber gasketed joints, now becoming so popular, to insure line flexibility. Also "newer," is the growth in use of 2-inch C.I. pipes (shipped in 18-ft. sections of two 9-ft. pipes) jointed with screw, rubber-gasketed, or pre-cast lead. Their chief uses have been for main extensions, tying in dead-ends and gridironing; for parks, golf courses, cemeteries, the larger services. For those areas where tuberculation may be a problem and water treatment for corrosion prevention is not practiced, C.I. pipes are now more prevalently supplied with bituminous or cement linings.

"What Is New in Metering" (Part I), by CHAS. BACHMANN, Neptune Meter Co., New York City; (Part II), by ALAN A. WOOD, Builders Iron Foundry Co., Providence, R. I.

MR. BACHMANN reviewed the history of small meter

Edw. H. Ruehl, Engr., Va. League of Munic., Richmond; F. O. Baldwin, Chief Chemist, Water Dept., Richmond; R. W. Fitzgerald, Chief Chemist, Div. of Water, Norfolk.

production. Chief improvements of customers' meters in recent years had largely been the use of improved gages and alloys. He predicted many years will pass before manufacturers will change the principal design of the present day consumer meters.

MR. WOOD, with the benefit of lantern slides, described three new developments of Builders Iron Foundry Co. First, the Kennison Nozzle, which is a simple device for placing on the end of free discharge pipes. Such nozzles produce head-flow graphs similar to that of a weir, showing large increments of head drop for small changes in rate at their departure from a straight line when flows drop extremely low. An installation for measuring sludge return at the new Columbus Sewage Plant was pictured. The indicating and recording instrument was also shown, operating on a maximum head loss equal only to the diameter of the pipe. Good sensitivity was being had with Kennison nozzles, recording water flows down to 5 per cent of maximum capacity.

The Chronoflo Summation Gauge has recently been developed to receive electrically transmitted readings from individual meters (remotely or closely located) and add all readings at intervals to produce summation readings—indicating, totalizing, or recording.

Remote Pump Station Control was the third new development. The layout illustrated involved a Chronoflo Meter for water elevations and another for flow, each utilizing a single wire to the control station. A selector dial (same as a telephone dial) is used to control the operation of pump, valves or other units through a single wire circuit, subject to use also as a telephone circuit when desired. Dial a single number and the desired pump is started, another number and the valve is opened, a third and the pump is started. Signal lights indicate the operations as they are under way at the remote point. Simplicity was the distinctive feature, a recent installation at Oklahoma City being that pictured and described.

"What Is New in Coagulation," by BURTON W. GRAHAM, Chemist, Activated Alum Corp., Baltimore, Md.

Mr. Graham presented a scholarly discussion and review of the principles of coagulation and floc formation. Unfortunately, the audience was deprived of hearing much of that part of his paper dealing with the specific properties of the products manufactured by his company—"Activated Alum" and "Black Alum"—due to the fact that, having over run his time limit, he was crowded at the end and skipped hurriedly through the most interesting part of his paper—"What Is New."

He emphasized the fact that in general the higher the valence of the metal of the coagulant the larger and more spontaneous the coagulating effect in pH zones of optimum value. The beginning of a new era in water purification dated back to 1931. Since, one had seen strides made in flocculation by mechanical devices, the demonstrated value of ferric iron salts; the marked effects of pre-chlorination, and even super-chlorination of the raw water, such as practiced at Richmond and later elsewhere; the effects of clays (bentonite) and small amounts of finely ground activated carbon in enhancing floc formation, weighting floc, creating aseptic conditions to keep the sludge "sweet" for longer periods. He spoke of the growing use of sodium aluminate in improving softening precipitations and sweeping out colloids, including undesirable magnesia and silica; also the value of ferric coagulants in the better removal of silica. Strangely enough, Baylis had recently announced the catalytic like effect of neutral silicates added with coagulants to create larger, heavier and very markedly tougher floc conglomerates.

In touching on his company's Standard Activated Alum, he said that the finely ground insoluble portions of the bauxite, left in, served to especial advantage in those waters void of silt or clay particles to serve as floc nuclei. Since titanium, with a valence of four, was one of the very most powerful coagulating metals, it had proved a valuable activating agent. Titanium in small quantities went into all activated alum. "Black Alum" was compounded by additions of requisite amounts of powdered activated carbon to standard activated alum. The scientific explanation of the so-called catalytic effects produced by the carbon in floc production was as much an unanswered question to his company as to others.

"What Is New in General," by W. W. BRUSH, Editor, "Water Works Engineering," New York City.

MR. BRUSH, speaking on the licensing of water works operators, said that licensing had been made legally compulsory in New York as of October 1, 1937, and in Ohio at a somewhat earlier date, together with a voluntary licensing system in South Carolina. In Pennsylvania, the State Legislature has asserted the ownership by the State of the waters within the State and has provided for the payment of a fee not to exceed $1.00 per million gallons that might hereafter be allocated to water supply control use. The establishment of the fee was, however, optional with the State Water Control Board. A deep-well turbine pump with its motor located below the pump, therefore operating continuously submerged, represents a radical departure from previous practice for this type of pumping. The rapid increase in the extent that fluorine has been found to be present in water supplies emphasizes the importance of the research to find means of removing fluorine from water supplies. Use of bone contact as a means of absorbing the fluorine, developed by the Smiths of Arizona, was referred to as an encouraging development in this field.

"Passing It Along"

"I Will Pass It Along for What It's Worth," was the theme of an hour of *"Experiences,"* which is always an interesting part of any meeting.

REGINALD BLANKENSHIP (Town Mgr., Orange, Va.) told of the method of removing tuberculation from reclaimed pipes by putting a logging chain through and a buck-nigger on each end to pull it back and forth, cross-

Prof. Robert Carroll of V. M. J. and "Keydett" Seniors. Dennis (A. P.); Taylor (P. H.), and Earnest (A. K.).

saw wise. Then a scheme of anchoring bends and tees to building walls with rods and turn-buckles. He had successfully dried out flooded motors by mopping with rags and building fires in the room to keep it as hot as seemed safe, and the use of electric fans to circulate the air through the coils.

CHAS. H. BLIVEN (Supt. of Water, Norfolk, Va.) told of a recent stand-pipe failure which had been caused by a wind reaching 70 miles per hour. The 90-ft. high pipe was, at the time, empty for painting. The top buckled in before it finally went down. The vertical trough formed caught the wind like a sail. The lesson from the accident would seem to be the requirement of stiffening rings in the upper sections. Naturally nothing would have happened if the pipe had been fairly full, but the storm would not hold off to let them put it back in service.

CARL J. LAUTER (Chief Chemist, Water Division, Washington, D. C.), in commenting on bacterial pick-up in distribution systems, said that 48 hr. counts had been found to give a picture on the Washington distribution system that revealed bacterial conditions which were not detected with 24 hr. counts. His findings were in the direction commented on by Mr. Enslow in explaining dead end troubles. In tap samples, even where there had been no stirring up of main deposits or slime, 800 per cent more bacteria were found after 48 hr. incubation than the customary 24 hr. tests revealed—namely, 234 as against 27 per cc. By the same comparison there was a 300 per cent increase through the filter plant basins and filter effluents showed counts of 65 as against 14. Mr. Lauter said that the significance remained a question, but he wondered if there might not be some correlation between 48 hr. counts and some of the many gastro-intestinal outbreaks which had thrown suspicion on water supplies of late.

In propounding the question, What to do about it? Mr. Lauter answered by suggesting that chemists might find raw water chlorination, followed by post-treatment with ammonia-chlorine, the solution. In fact, superchlorination, such as, in effect, is practiced at Richmond, might have to be more universally considered and plant control put on the basis of 48 hr. counts. Then, for the purpose of preventing growth in the distribution system, post-chlorine dosage with ammonia, for taste prevention and fixation of the residual.

J. W. KELLOG (Raleigh, N. C., Chairman of the N. C. Section) was of the opinion that Mr. Lauter had struck an important key-note. He could check him on his findings, having found 10,000 bacteria per cc. on main samples after 48 hrs. In many ways chloramination to carry residual to the far corners had an appeal as a worthy practice.

D. R. TAYLOR (Supt. Roanoke, Va., Water Company) related some of his experiences in dealing with customer complaints, excess billing in particular. He had found the recording chart attachment, to go on complainants' meters, a god-send in settling disputes. He exhibited a sample chart from which he read the daily habits of that particular household in respect to number of baths taken, number of times the toilet had been flushed and the minute of day and night; the time the dishes were washed after each meal, the time that son Johnnie got home from a party, or "something." Reciting such a case history to the consumer seemed like "taking cake from a baby." There ended all argument concerning meter "ability" and accuracy. It was truly a case of "one picture being worth a thousand words."

Mr. Taylor gave a table (published by H. V. Pedersen of Marshalltown, Ia., in the Journal of A. W. W. A.) which he had found very useful in settling arguments. It had been set up for the average household, to show the relative amounts of total average consumption which could be accounted for by household uses. The list follows:

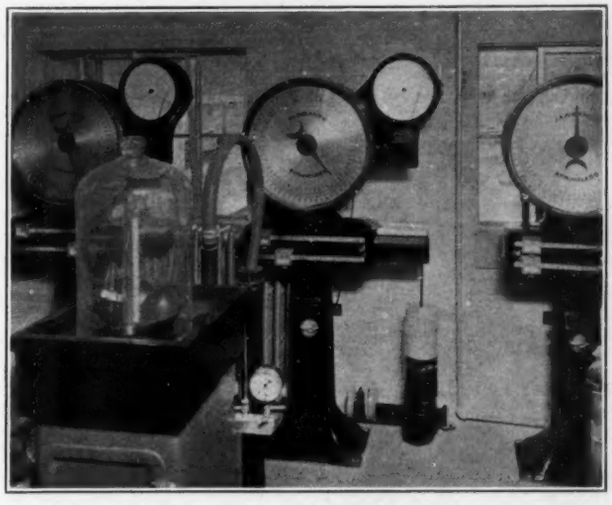
Use of Water	*% of Total*	*Use of Water*	*% of Total*
Laundry	4	Toilet flush	45
Sprinkling	3	Bathing	30
Auto. wash	1	Kitchen	6
Drinking	5	Cleaning	3

So, if a customer explains that he hardly ever sprinkles; sends his laundry out; has no cook to leave the spigot run in the kitchen, Mr. Taylor just pulls the list out and shows the customer a picture that surprises the average man considerably.

At the close of the meeting President Dugger asked the floor just long enough to tell a little of the plans for the New Orleans Convention, late next April. Anyone knowing the glamour of this famous city would do everything possible to get down there. Get it on the budget, or get it some way. Just don't miss New Orleans, were his parting words. And then the gavel fell.

Denver's Chlorine Control Scheme

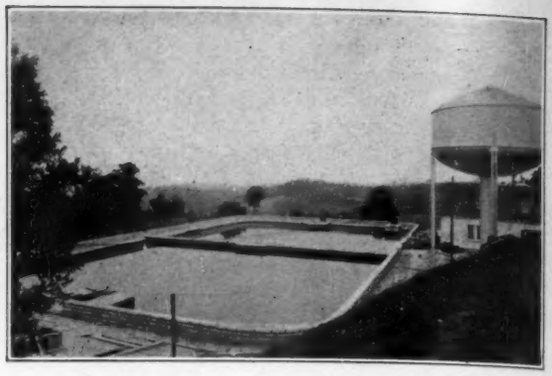
In the recently completed West Side Filtration Plant of Denver, Colo., an interesting chlorinator installation involves the use of unique recording scales. The dials of these scales, and weighing and recording mechanisms, are located in the chlorinator room on the operating floor, whereas the scale platforms are on the ground level below, for the purpose of greater ease and safety in handling chlorine and ammonia containers. The gas is piped up to the chlorinators, and any re-liquefied



Chlorine Control Scheme at West Side Filtration Plant, Denver, Colo.

chlorine gas in the line readily drains back to the containers or drip-pots below.

The unique feature of the four Fairbanks recording dial-scales is that it is possible for operators to tell by a glance, at the pen charts, how much chlorine has been used and how much remains in the containers on the scales below. Each scale has two tare beams and the counterpoise weights are painted two different colors to identify their use. One beam sets off the weight of the container. The other, in conjunction with the dial chart reading, shows the net content of the container at all times. The scheme is intended to increase accuracy of control, fix operator responsibility, and preclude waste due to removal and return of incompletely emptied containers to the manufacturer. Alvord, Burdick and Howson were consulting and designing engineers.



Fairmont's Spic and Span Plant. Has a Gleaming New Wash Tank.

WEST VA. WATER OPERATORS

Hold Highly Successful Meeting in Fairmont, W. Va.

FAIRMONT—"The Friendly City"—was host to the West Virginia Water Works Operators Conference, which held its 12th Annual Meeting in that progressive city October 21, 22 and 23. With a splendid program and an attentive and enthusiastic membership we can say that few technical sessions of such meetings have been better attended than those in Fairmont, where the official registration reached 118.

Fairmont proved its claim to being "The Friendly City," and Fairmont's Superintendent of Water and Sewerage—J. Clyde Morris—proved a number one citizen of this wide awake "Coal Capital" in a prosperous mining area. To meeting and banquet came Fairmont's Mayor Wilson to officiate and, later, to mingle with visiting mayors who came to see their water works operators in action. The local press took more than usual notice of the meeting, as evidenced by the liberal front page space devoted to it. [In passing, it can be said that the West Virginians have always been able to secure an unusual amount of helpful water works publicity in their newspapers.—Ed.] Also, did Fairmont contribute the live-wire Chairman J. H. Buchanan, of the Monongahela West-Penn Public Service Co., long a wheel-horse in the conference.

Even in the face of threatening weather conditions, the attendance was boosted without much doubt because of a splendid job by Superintendent Morris in mailing to West Virginia operators a special letter of invitation urging each to come to Fairmont. With it was sent a specially produced "Welcome to Fairmont" booklet depicting Fairmont's assets, but featuring its water works and new publicly owned swimming pool constructed with WPA aid and subscriptions to revenue bonds by Fairmont citizenry.

One afternoon was devoted to a trip through one of West Virginia's modern and most important power generating stations built on top of a coal mine, then to the new swimming pool and, finally, to Fairmont's spic-and-span filtration plant located high above the city on a hill-top in picturesque Reservoir Park. Prior to the trip members were luncheon guests of the Water Department.

J. K. Buchanan (Fairmont), Retiring Chairman.

A. R. Todd (Wheeling), The New Chairman.

Conference Considers A.W.W.A. Affiliation

Following the complimentary remarks of Mayor Fred T. Wilson, in discussing the meaning of efficient water works operation and management to a community, the Conference launched into its Business Session and discussion of a proposal made to reorganize as the West Virginia Section of A.W.W.A. West Virginia being at present included in the Central States Section of A.W.W.A., E. C. Trax, Chairman of that Section, had been requested to come to the meeting to present his views on the subject. Following floor discussion, in which it came out that the Michigan Conference had recently voted to apply to A.W.W.A. for affiliation, Mr. Trax presented a review of the advantages and disadvantages which would accrue to members of the Conference should it become a Section of A.W.W.A. At the possible price of being branded a traitor to the Central States Section, it was his personal belief that A.W.W.A. could best serve water works men in general through single, or, at most, twin-state sections rather than regional sections. By establishing more numerous sections A.W.W.A. meetings could be annually reached by the greatest numbers; there would result a strength built up of A.W.W.A. through more members and closer contact. The result would be the needed higher recognition of water works operators, added publicity and increased security—legally and morally procured. Mr. Trax could see but one disadvantage—the $10.00 per year membership fee to cover the cost of A.W.W.A.'s monthly Journal and running expenses of the Association. Proposed and likely of favorable action by A.W.W.A.'s Board of Direction, was an affiliate grade of membership at a reduced fee more readily payable by underpaid sub-operators.

It was voted to refer the question to a committee of leading members named by the Chair—with which Mr. Trax and L. H. Enslow were asked to sit. This committee, instructed to report at a later business session, brought in several reasons leading to its recommendation that affiliation with A.W.W.A. as a State Section be given prompt and deserved consideration. After discussion, and upon motion by Lewis V. Carpenter, long a main-spring of the West Virginia Conference, and

Wm. Kirschman, Chemist (Fairmont), Named Vice Chairman.

J. Clyde Morris, Supt. (Fairmont), No. 1 Citizen and Host Extraordinary.

now representing the Central States Section on A.W.W.A.'s Board of Direction, it was voted to name a committee to investigate, study and report further, looking toward taking definite action provided that existing and future Conference members would not be excluded from membership because of their lack of the $10.00 annual dues. It was a plain and plausible case of the West Virginia Conference saying to A.W.W.A.—We wish to join with you in your avowed program of "doing things" for the water works profession. But we do believe that the Conference serves many men who will lose its advantages by being forced out if the membership fee is prohibitive. We will await further developments in respect to a membership grade of lower cost in A.W.W.A. before taking from West Virginia operators the advantages offered at nominal cost in our 12-year-old organization. The next move is distinctly up to A.W.W.A. in the matter of "maximum service to the greatest numbers" and West Virginians are standing on safe ground when they as much as say to A.W.W.A.—"Take care of our young and underpaid operators, and we are with you in your movement toward service to the water works profession as a whole."

The Committee on A.W.W.A. Affiliation consists of A. R. Todd, Wheeling, Chairman; Mentor Hetzer, Moundsville; Golden Underwood, Parkersburg; J. C. Edwards, Huntington; T. L. Young, Chester.

New Officers

The following, presented for offices by the nominating committee, were unanimously voted in for the ensuing year:

Chairman—A. R. Todd, Supt. of Filtration, Wheeling.

Vice Chairman—Wm. Kirchman, Supt. of Filtration, Fairmont.

Sec'y-Treas.—J. B. Harrington, State Dept. Health, Charleston.

Executive Committee—J. Clyde Morris, Fairmont; Mentor Hetzer, Moundsville; Golden Underwood, Parkersburg; in addition to the officers.

Technical Sessions

(J. K. Buchanan, Presiding)

"The Practical Side of Alum Manufacture for Water Works Use," by FRED. E. STUART, President, Activated Alum Corp., New York City.

Mr. Stuart presented an easy to follow description of production, from raw materials to finished coagulants, in the new plant of Activated Alum Corp., located in Baltimore, Md. Especially interesting to coagulant buyers and practical water works men were the features of the special equipment, novel methods in filter-alum manufacture, and procedures in purification and compounding of special coagulants which had been patterned upon basic principles involved in water treatment practices. Here was a plant designed by water works men, operated by a former water works superintendent and managed by water works men, who also tested, recommended and sold the coagulants produced for the job best suited to each. Any water purification man would find the Baltimore plant operations, with automatically controlled processes and equipment, of great interest and readily understandable. An invitation to inspect the plant was extended to all water works men. Possibly because of the several representatives of competing alum manufacturers on hand to hear how "Activated Alum" and "Black Alum" are produced, Mr. Stuart presented only the basic principles of the process, giving away no "trade secrets" and only a smattering of the novel schemes in the Baltimore plant operations.

In filter alum manufacture, all important, said Mr. Stuart, was the fine grind and quality of the aluminum oxide bearing mineral (Bauxite), produced mostly in Georgia and Arkansas. In hot sulphuric acid (temperature control being important) the requisite volume of the heavy bauxite powder is dumped, to be followed by violent frothing reaction to produce sulphate of alumina (filter alum), and requiring careful control to prevent boil-overs of the lead-lined reaction pot. To the still frothing mass, just before dumping to the cooling floor (shallow crystallizing vats), the activating elements are added. It would be noted that the mud (about 10 per cent by weight) all remained in the alum syrup to produce a "cake" filled with tiny voids, readily dissociated in dry feed solution pots and liberating the many mud and silica nuclei to assist floc formation, and add settling weights thereto. After "cake stripping" came the roller-mill crushing, following by costly high speed multi-stage pulverizing units discharging to new triple-deck grading screens, shaking at 3,600 vibrations per minute, from which the intermediate and uniform "rice-alum" went to bagging hoppers. In the manufacture of purified (iron free) alum, such as specified for most industrial uses and erroneously considered by some as the most appropriate alum for water works use; the process was considerably more tedious, time consuming, and costly. In the Baltimore plant the process is a continuous slow moving one, in many respects operating like a water softening plant provided with long mechanical mix, primary settling, and coagulation (aided by glue) to settle the mud in the secondary continuous flow settlers. Then followed the evaporation and more clarification before the clear syrup is drawn to the cooling vats. The pure cake passes through the same crushing, multi-grinding, sieving and bagging process as the "Standard Activated Alum." It was pointed out that, as activating or purging agent, to some grades of alum titanium-oxide is added; to others hypochlorite; to others activated carbon. The finished alum is sold as refined, or as basic mud-

J. B. Harrington (Charleston), Capable Secretary, "J. B." Smiles and Means It.

Prof. Lewis V. Carpenter (New York University), Former "Main Spring" of the Conference; Came Back Home.

Mentor B. Hetzer, Mgr. (Moundsville), One of Those "Back-Log" Irreplacable Members.

E. S. Tisdale, Chief Engr., W. Va. Dept. of Health, Appreciates Value of Cooperation and "Good Will"; Gets It.

alum, or compounded with carbon to produce "Black Alum." Always seeking other improvements, experiments were under way on other combinations with copper salts, ferric iron, etc.

The "rice alum," from the 10-mesh sieve seemed the overall most satisfactory grade for dry feeders, because it was uniform, free-flowing and essentially dust free.

1. W. D. Kelley, Pub. Service Comm., Charleston, and M. D. Step, Water Supt., Kermit; 2. Ed Eilers, Pittsburgh Meter Co. and F. M. Offut, Mgr., Water Works, Williamson; 3. Lou Birdsall, Gen. Chem. Co., Chicago; 4. Mayor Fred T. Wilson of Fairmont and his friend, J. Clyde Morris, Supt. of Water and Sewerage; 5. E. T. Roetman, State Dept. of Health, and Kenneth Watson, State Water Comm., Charleston.

For ease in handling, activated and black alum was being packaged in extra strength multi-ply paper bags, holding 100 lbs. each. In selecting the bags, Mr. Stuart explained that many styles and quality had been put to actual shipping and handling tests—that selected being a patented simple opening dust-tight bag that could be kicked around pretty severely.

Although his talk was carefully guarded as to the "kinks" in "Activated's" alum making processes, Mr. Stuart's presentation contained much of interest, as shown by the attentive audience.

[We have given considerable space to Mr. Stuart's presentation due to the fact that he feels that the paper he had prepared contains material which, upon reflection, had best remain unpublished. In this "digest" we have possibly included more than Mr. Stuart may feel happy over. However, statements have been restricted to those covered in notes taken in the open meeting.—ED.]

"Reclaiming and Cement Lining Cast Iron Pipe," by WILLIAM STAUB, Engineer, West Virginia Water Service Co., Charleston, W. Va.

Mr. Staub related experiences in the removal of tuberculated C.I. pipes (4 to 30 in.), their cleaning and lining with cement mortar, involving 9 miles of pipe to date. On elevated rail cleaning-racks, the pipes were first dried out with gas burners run through sizes less than 12 in. diameter, and wood fires built in sizes above. The tubercules, loosened by such dehydration and decarbonation (also much of the tar coating) were easily jolted loose and flushed out with a fire-nozzle stream. Then rolled onto the pipe revolving and lining machine, insertion of an iron bar and thereafter wire brushes on poles into the spinning pipes completed the preparation. Then the pipes were blown out with air and wetted inside once more and the cement mortar dumped in from an 18 ft. long trough thrust into the pipe, revolving at a rate of approximately 250 ft. per min. peripherial speed. Finally the speed is boosted to 550 ft./min., for 15 seconds, to produce a smoother interior surface and denser lining. Mr. Staub stressed, as the most important feature, the mortar mix of 2 parts sieved Portland Cement to 1 part of clean screened river sand (16-mesh screen) and only sufficient water to produce a stiff mortar having no more than a 2-inch slump. After lining, the pipe ends are closed with paper to hold moisture in while curing for 7 days. He described the very simple variable-speed lining machine consisting essentially of revolving wheels along each under-side of the pipe to form a trough in which the pipe is laid. Only one set of wheels revolved on the shaft (belt driven by a slip-ring motor) to roll the pipe.

Concerning costs—the equipment required had cost $2,200 installed. The total labor and materials divided 80% for cleaning and preparation and 20% for lining. Three thousand (3,000) feet of 12-in. pipe had been lined in a 9-hr. day. Mr. Staub's paper contained numerous cost data tables but only the following summarial table was read:*

Diameters	*Salvage, Cleaning + Lining (% Cost of New Pipe)*	*Total Cost per ft.*
4 in.	34.7	26.1c
6 in.	31.8	35.8c
8 in.	38.5	46.6c
10 in.	28.3	62.9c
12 in.	27.0	77.4c
18 in.	22.4	$1.21
24 in.	18.5	$1.58

In reply to questions, Mr. Staub stated that it had been necessary to use but one size mortar pouring trough on all pipe sizes—the trough making two trips for the largest pipes. A 3/16-in. lining had been used on all sizes. No trouble had been experienced in cutting cement lined pipes. Service-tap holes had been reamed, threaded and closed with a plug before lining. The salvage costs had not included paving cutting because the pipe came from

Good on Any Program

Martin E. Flentje, Amer. Water Works & Elec. Co., New York City; Fred E. Stuart, Pres., "Activated Alum," Baltimore, Md.; Wm. S. Staub, W. Va. Water Service Co., Charleston.

Engineer—Teacher—Manager

Wilfred Jupenlaz, Morris Knowles, Engr., Pittsburgh, Pa.; Prof. H. W. Speiden, Univ. of W. Va., Morgantown, W. Va.; T. L. Young, Mgr., Southside Water Co., Chester, W. Va.

a war-time development which had not been completed and there was little or no paving. Only a small percentage of the spigot ends of pipes had been broken or split in the taking up, which was done on contract for so much per ton of pipe. Only after trial had they struck on the correct water content of the mortar to make a dense smooth lining, but avoid water-trickle grooving due to too much water. Revolving speed boost at the finish to double the speed during application had been very helpful in producing uniformity of thickness, density and smoothness of lining. Interior burning to remove tubercules was apparently novel, being highly effective and also relatively inexpensive with natural gas available.

C. J. BRUCE, Supt. Cumberland, Md., revealed an experience in getting rid of water-trickle in centrifugal lining—the scheme being to fix to one side of the dump trough a strip of belting to skim off the watery mortar from the lining surface, and back into the trough at the finish.

"The Osmoscope—A Demonstration of Its Use," by LAWSON HAYNES, Plant Supt., W. Va. Water Service Co., Charleston, W. Va.

Mr. Haynes, with 20 years of experience in operating filtration plants, commented on what operators were expected to do today as compared with only a few years back, in the way of furnishing a water wholly acceptable to the consumer in every way. A great boon had been the developments in odor and taste control methods and materials. Of equal value to the operator, with many waters to watch, had been the modern "sniffing-tool"—the Osmoscope—developed by Fair and Wells. It was this instrument, resembling a flute, which he demonstrated—the principal being a series of dilution orifices for detecting the "pO" value of water samples and, therefrom, the threshold odor number of Spaulding and Baylis. The water dilution method, for reaching the threshold odor number, was in comparison cumbersome and time consuming and required much odor free laboratory glass ware. In checking many water samples, in many plants, the "Osmoscope" had been a God-send to the speaker. Resulting from its use, had come better control without slips and with treatment, when, where, and of the order required with economy of chemicals.

In reply to questions, Mr. Haynes said the "Osmoscope" threshold number and that from the dilution method, with odor free water rather than air dilution through the sniff holes, had checked perfectly. The instrument had been used in evaluating carbons. For finished water a threshold number of 8 had been fixed as the upper limit to avoid complaints. In routine plant control the operators observed odors on heated raw water samples, as a check against what might happen. When necessary the "Doctor" with his Omoscope was called to check the diagnosis and prescribe treatment. To the obvious question came the reply that the instrument is procurable from Eimer and Amend; the price $35.00 in the carrying kit.

L. H. ENSLOW said that most frequently taste and odor troubles came on gradually, unless the cause was from a sudden dumping of some industrial waste. The onset from natural causes could frequently be foretold in advance of trouble making proportions if samples of raw and settled waters were taken and slowly distilled as in the free ammonia distillation. The first portions of the distillate would contain the odor producing fractions in concentrated ratio and give the operator the warning signal. The scheme was in reality the reverse from the dilution method, and a more delicate method than that of sniffing undiluted heated catch samples. His recollection was that the scheme had originated at the Beaver Falls, Pa. plant.

1. Dean McCrory, Penna. Salt Mfg. Co., Pittsburgh; 2. Harry Schmidt, U. S. Pipe and Foundry Co., Pittsburgh; 3. Jo Egolf, Ludlow Valve Co., Pittsburgh; F. M. Offut, Mgr., Williamson Water Dept.; 5. A. J. Dotterweich, Permutit Co., Pittsburgh; 6. A. B. Baumann, Supt., Mannington, W. Va., Water Co.; 7. H. C. Kneeland, Cons. Chemist, Bellevue, Penna.; 8. Fred Durner, Mathieson Alkali Works, Pittsburgh.

Something New in Taste Preventatives

"The Prevention of Phenolic Tastes in Treated Ohio River Water," by A. R. TODD, Supt. of Filtration, Wheeling, W. Va.

Mr. Todd stated that coagulation at Wheeling was simple enough—so simple in fact that nothing but lime treatment of the raw water had been required during more than half of the year when the Ohio was low and the iron content (mine drainage plus steel mill pickling liquors) averages 6 p.p.m. Fe (high of 12 p.p.m.) and the pH 5.2 and lower. Because of the concurrent rise in phenol content of the river, however, it was during such periods that tastes complaints mounted and, therewith, the carbon bill. Experimentation had shown that the lime treatment for coagulation in high pH range, to effectively oxidize the ferrous iron, was the very worse thing that could have been done when comparing the taste results in alkaline coagulation against acid zone coagulation. On repeated tests it was evident that the lime application intensified tastes, so acid zone coagula-

(*Mr. Staub's effectively illustrated and meaty paper will be presented in full in a near future issue of WATER WORKS AND SEWERAGE.—Ed.)

Superintendents of Filtration

P. L. McLaughlin, W. Va. Water Service Co., Charleston; Perkins Boynton, Water Board, Clarksburg; John C. Edwards, Huntington Water Co., Huntington.

tion with ferrous sulphate and chlorine was resorted to with highly effective results to date.

The new method involved a fixed quantity of chlorine and sufficient copperas to bring the pH value of the treated water to 5.7, or under, regardless of the initial iron content of the raw water. The copperas solution and chlorine (only 1 lb. per M.G. being needed and no necessity of dosage variation so far) are added simultaneously. When the floc is produced in the acid zone, 15 minutes later the lime can be added to adjust the pH to optimum and produce completed flocculation *without* taste production. Interestingly, raw water pre-chlorination ahead of the copperas had not given as good results, even in much larger dosages, because the iron in the raw water had been too quickly precipitated as fine red oxide. The lower chlorine dosage, merely to assist in floc formation, had given higher efficiencies throughout. (In this issue it is hoped that we will be able to print an article by Mr. Todd which more fully describes the Wheeling taste betterment scheme, along with other operating kinks.—Ed.)

"Turning to Ferrous Sulphate as a Coagulant," by PAUL SIMMONS, Chemist, Weirton Steel Co., Weirton, W. Va.

Mr. Simmons told of a hard to comprehend story of a steel mill employing filter alum and lime in coagulating the iron bearing (pH 4.3 to 6.5) water of the Ohio, 60 miles below Pittsburgh. What put a stop to this "mixing of drinks" method was the discovery of considerable manganese in the effluent of the Weirton plant, where coagulation was being procured at pH 7.1, as the alum floc optimum, with more lime added in post-treating the filtered water.

To make a long story, of distribution troubles, short (and the effluent "sweet") Weirton now pre-chlorinates the raw water (2.6 p.p.m.), uses copperas as the coagulant, adds lime to produce pH 9.6 in the coagulation phase secures, 9.2 in the finished water, uses ammonia to preclude tastes, and maintain residual chlorine. Results: Markedly reduced wash water, red water troubles no more, meter corrosion stopped, and manganese troubles are over; and, it is believed, main tuberculation has been stopped. The new treatment was introduced January 1, 1937.

Mr. Simmons pointed out that preammonia treatment is also employed in the ratio of 25% ammonia to the pre-chlorine dosage, averaging 2.6 p.p.m. in 1937 as compared with 2.00 p.p.m. in 1936 when alum was the coagulant. A short run with chlorine added to the copperas solution, to produce chlorinated-copperas, showed improved results in clarification and bacteria removal. However, with the high pH coagulation, pre-chlorination alone seemed sufficient. In the discussion it was brought out that the copperas (ferrous sulphate) had cost between $10.90 and $13.50 per ton in 1937.

"Results of Zeolite Softening at Morgantown, W. Va," by MARTIN E. FLENTJE, Chemist, American Water Works & Electric Co., New York City.

This paper scheduled to be given by F. T. O'Connell, Manager, Morgantown Water Company, fell to Mr. Flentje to present who, with lantern slides, described the economically constructed and uniquely arranged and operated combination lime and zeolite softening plant of Morgantown. Until the installation of this new plant consumers had been served with an extremely soft mountain water until the near exhaustion of the supply each fall necessitated the use of the auxiliary filtered Monongahela River supply, with hardness varying between 70 and 250 parts per million. With the new plant a product of 50 to 60 p.p.m. hardness had been uniformly and automatically produced—the first stage being lime precipitation to remove about 50 per cent of the hardness and *up-flow* zeolite units (green-sand) to completely soften the required portion to mix with the partially softened product and maintain the 50 to 60 p.p.m. balance. The operating procedure involves determination of hardness of the lime softened (filtered) water and from a mixing ratio chart, the portion of the plant output to pump through the *up-flow* zeolite units is arrived at and adjusted with a variable speed motor-pump unit. Likewise, the calculated hours of service expected of the zeolite units is chart indicated for the combination of rate and hardness. As the "zero-hour" of bed exhaustion approaches hardness checks are made on the zeolite effluent. Ordinarily three units are regenerated at one time while the fourth (stand-by unit) is put to service during the regeneration period. Mr. Flentje explained that the up-flow principle was employed because of the belief that longer runs, less head loss, and greater economy are realized. To date the records for salt consumed indicated an increasing economy with longer operating experience, averaging about 0.45 lbs. of salt per 1,000 grains of hardness removed and sometimes dropping to less than 0.40 lbs. Considerable attention had been given the design of the zeolite plant to simplify and ensure consistent operation at maximum economies. The up-flow rate varied between 4 and 8 gals./sq./ft./min. without loss of the green-sand. Regeneration involved 25 per salt solution diluted automatically to 5 per cent and drawn downward through the beds for a 30-minute period, followed by a 30-minute up-flow rinse which was recovered to serve as brine diluting water in the ensuing regeneration.

Developments in Water Purification

"Recent Developments in Water Purification" were reviewed by Professor LEWIS V. CARPENTER of New York University, formerly head of the Sanitary Engineering Dept. of the University of West Virginia, and "No. 1 Energizer" of the W. Va. Conference.

Back home again Carpenter let loose, in a style for which he is reputed, to give a class-room talk on what's new in water treatment. Therein, he emphasized efficent methods and processes of raw water preparation involving mechanical flocculation; the precipitating up-flow of influent water, treated with softening chemicals, through the sludge blanket (Spauldings Precipitators); the newer coagulants chlorinated-copperas, "Activated Alum," "Black Alum"; silicates as an aid in coagulation. He said that water purification men were too prone to adhere to filter alum when other coagulants might well prove more effective or economical, if given a trial.

Concerning filters; the sub-surface method of washing, developed by Baylis and Jewell independently, seemed the outstanding development and looked to be the most effective and economical method of keeping sand beds clean. The Baylis design was described in some

detail. He pointed out the advantages of anthracite as a filtering media—principally its light gravity—and the potentialities of porous bottom filters. He called attention to the Magnetite Filter, and progress being made in its study as a water strainer at Portland, Me. An interesting device, it looked to have a place in water treatment as well as the sewage treatment field, where it had made good.

Professor Carpenter then devoted some time to an illustrated portrayal of the hazards of plumbing cross connections and possibilities of water supply contamination from back syphonage of sanitary fixtures. He asked the Chair to call on L. H. Enslow to amplify his review in respect to chlorination developments. Mr. Enslow used as a theme, suggested by Prof. Carpenter's talk, that of "Keeping Good Water Good." He told of the value of "Chloramination" (Ammonia-Chlorine treatment) as a measure of carrying residual chlorine throughout the distribution system to counteract possible infection due to minor cross connection failures; but, more universally important, the maintenance of more nearly sterile mains resulting in less degradation of the water in dead ends or sluggish sections, with consequent corrosion and red water followed by oxygen deficiency (decay) and the resulting odorous black-water, familiar to many during hydrant blowings.

1. Earle Johnson, W & T Co., Pittsburgh (New Secretary of A.W.W.A.'S Central States Section); 2. E. A. Morgan, Chief Operator, Wellsburg; 3. Wm. Baumgartner, Chem. Engr., Du Pont Co., Wilmington, Dela.; 4. F. T. O'Connell, Mgr., Morgantown Water Co. (To Him Softened Water Brought Customer's Thanks); 5. John R. Sproat, Pittsburgh Equitable Meter Co., Pittsburgh; 6. George Riffe, Supt., Shinnston, W. Va., Water Co. (Proud of His Spic and Span Plant Also); 7. A. B. Sanderson, Sales Engr., Pittsburgh Des Moines Steel Co.; 8. Tom Quigley, Pardee Engr., Co., Long Island City, N. Y.

"Elementary Hydraulics as Applied in Water Purification Systems," proved to be a lecture-demonstration by Professor H. W. SPEIDEN of the Dept. of Civil Engineering of West Va. University. In a digest of this sort Prof. Speiden's lecture can be given by title only. He discussed fundamentals and developed formulae for orifices, filter bed flows, loss of head, Venturi tubes, et al. With black-board and laboratory equipment the impressive part of his exposition were the demonstrations made to illustrate the talk. We are still looking in all 5 and 10 cent stores to locate that tricky self starting syphon for skimming cream from bottles of milk, which the Professor used so effectively to demonstrate "practical applied hydraulics."

"The Human Element of Public Relations," by MENTOR HETZER, Manager, Moundsville Water Co., Moundsville, W. Va.

Mr. Hetzer, reputed as a manager who practices what he preaches, came forward with a pinch-hitting paper on the never dry subject "How to Make Friends for the Water Utility." He said that the starting point in the "human-element" consideration was the "hiring-line" in the manager's office. So much depended upon the personal appearance and disposition of employees coming in contact with the public that he wished to emphazie and expound what he considered the four fundamental employee attributes, as: (1) Pleasing Appearance; (2) Courtesy; (3) Friendly Attitude; (4) Genuine Interest in Customers. Mr. Hetzer emphasized that fact that substantial rewards lay within public-opinion and the so-called good will of customers, whether the affected business be privately or publicly operated. Nowhere had this fact become more evident than in the public utility field during recent times. (Mr. Hetzer might have added as proof of this assertion a study of what happened to water works managers and superintendents during the late depression. Where effective "good-will" had been established the utility or water department boasted many fewer uncollected water bills, and the manager enjoyed "good health" and but little curtailment of income. On the other side of the picture dissatisfaction resulted in changes in personnel, severely cut budgets and operator salaries, which have been slow to be returned in many municipal water departments.—Ed.) What Mr. Hetzer has stated to be foremost in his thought when on the "hiring-line" is this. *Men may be judged by the company they keep—BUT, "the Company" is praised or "damned" by the men that it keeps.* Equally so, the municipally operated utility.

E. S. TISDALE, Chief Engr., State Dept. of Health in complimenting Mr. Hetzer, called attention to the outstanding work of Scotland Highland in building good public relations in Clarksburg. It was the public's good will that brought about a demand for Mr. Highland's reinstatement, as manager of the publicly owned water works, when he had been relieved in a replacement by the Water Board after his many years of efficient service. He also cited the fact that floating bond issues for water improvements in Clarksburg had been no problem under Mr. Highland's administration. (Mr. Tisdale could have added a bit of personal history to his story. Himself, temporarily relieved from his present position only a few years ago, found that the friendly relations between himself, his staff, and water works managers in West Va., proved such genuine good will as to warrent spontaneous objections from this group, addressed to the new governor. Finding in his hands a "hot-chestnut," Mr. Tisdale's early reinstatement followed.—Ed.)

Unusual Sewerage Paper

"The Bluefield Sewage Treatment Works," by M. G. MANSFIELD and WILFRED JUPENLAZ, Morris Knowles, Engrs., Pittsburgh, Pa.

Coming in for deserved high compliment, was this paper, informally and interestingly presented by Mr. Jupenlaz. Outstanding was the clean cut, easily followed and readily understood method of describing the functions and results attained through the several units of the new treatment plants of Bluefield. His splendid presentation was predominantly educational and directed to men with little if any, insight into sewage treatment and plant functions; but, equally interesting and reveal-

Programmers

Gilbert Kelso, Engr., Public Health Center, Beckley; Paul Simmons, Chemist, Weirton Steel Co., Weirton; H. K. Gidley, Engr., State Dept. Health, Charleston.

ing to the experienced sewerage man. It constituted a talk of "selling" dimensions if presented before any civic group or town council; likewise, one to make water works men wish to know more about sewage treatment.

Here was an especially interesting case of Bluefield, W. Va., emptying sewage into a stream at a point just across the state line in Virginia. Close by Bluefield, *Virginia* used the same stream, and the Virginia and West Va. sewage then re-entered West Va. to produce complex questions of responsibility, State authority, legality of financing procedures, if a joint enterprise (Bluefield and Bluefield) be undertaken. Courts finally ruled that establishment of a Sanitary District and financing as a public utility, with the Bluefield Sanitary Commission incorporated also as a Sewerage Utility in Virginia, was legal. Results: An old plant revamped and enlarged; a new plant constructed within the city limits of Bluefield, Virginia, to treat sewage from the two sister-state cities; financing by sewer rental collected at rate of $5.00 per residence (minimum) by the Sanitary Board of Bluefield, W. Va., from both cities, as covered by effective ordinances; financing on a 45 per cent grant basis through PWA ($200,000) supplemented by $244,000 in 30 year serial 4% revenue bonds voted by the District.

To the existing East End Imhoff tank plant, further enlarged, sprinkling filters and chlorination were added, and the grounds beautified. For the new (Bluestone River) plant ground conditions warranted the selection of Imhoff tanks, in order to avoid double pumping required in case of separate digestion. Sprinkling filters 9 ft. deep were selected on the basis of overall costs, chiefly low operating costs of filters vs. activated sludge; glass-covered sludge beds to minimize odors; and because of limited areas. The plant, located in a residential district, is equipped for both pre- and post-chlorination.

Financing through the service charge involves sliding scale rate based on water meter reading as follows:

	Consumption	Rate per 1,000 gals.
1st	25,000 gals.	15 cents
2nd	25,000 gals.	14 cents
Next	50,000 gals.	12 cents

Thereafter a 2 cents step down rate for each of the next three increments of 50,000 gals. Finally, all above 250,000 gals. at 5 cents per 1,000. The minimum charge to any sewer user is $1.25 quarterly. From water billings the great majority of residences will pay the $5.00 per year minimum, but the estimated revenue expected will more than cover the fixed charges of roughly $15,000, and estimated operating casts of $22,000 per year. The population served is 20,500 by the new Bluestone Plant; 4,500 by the revamped East End Plant. The operating organization will consist of a superintendent, chemist, billing clerk, two plant operators and two assistant operators, plus temporary labor for general sewer maintenance.

"Stream Pollution Improvements on the Tygert River Basin," constituted a symposium introduced and directed by E. S. TISDALE, State Sanitary Engr., Charleston, W. Va., who summarized the improvements brought about by mine sealing which had relieved the Tygert River and tributaries of 100,000 lbs. of sulphuric acid per day. In addition, sewage treatment; treatment of wastes from leather tanning plants; available dilution expected upon completion of the large dam above Grafton, constructed for stream control.

C. L. CHAPMAN, U.S.P.H.S., Engr., who has charge of the Tygert Basin mine-sealing work, reviewed in some detail accomplishments to date in reducing the acidity of the streams by sealing abandoned mines—so far a 58 per cent effective curtailment in acid discharge, at a net cost of 18.5 cents per ton of sulfuric acid per year. He estimates that the 32 per cent acid, not yet reached, is coming largely from worked out portions of still active mines. The problem was what to do to relieve this loading, and now being studied.

In a joint paper by H. K. Gidley, Supervising Engr., Bureau of Public Health Work and G. L. Kelso, Sanitarian, Public Health Training Center, West Va. Dept. of Health, "The Relation Between Water Works Operators and the County Public Health Worker," was discussed. It indicated the assistance which the operators could lend.

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The Connersville Case—(A Correction)

We are very sorry to say that WATER WORKS AND SEWERAGE has been caught "off base" by the Public Service Company of Indiana. Criticism from the Contract Sales Division of this electric utility has come as the result of a brief article on page 376 of our October issue captioned, "Diesels Save Connersville $31.80 Per Day." It reports the fact that Connersville, Ind., now pumps its water supply with electricity generated by two Cooper-Bessemer engines of the Diesel type.

Here is the statement which is in error: ". . . purchased electric power previously averaged $46.00 per day; whereas, the total daily cost of operating the new plant—including labor, overhead and estimated depreciation—is $14.20 a day." We have checked back and find the Public Service Company of Indiana to be justified in the first of its objections to the article.

Truth of the matter, Connersville had been pumping water with an old and none too efficient steam plant. The somewhat startling newspaper article, from which our condensed account in the October issue was drawn, was discussing power purchased for street lighting along with the savings from water works improvements. The statement, "Electricity heretofore has been provided only through agencies of a utility service," appears in a location, making for the erroneous interpretation. For giving the wrong impression, indicating that the marked disparity was between purchased power and Diesel power, Public Service Company of Indiana is due this correction, and our apology.

Concerning the comparative costs of operation, as reported in the same newspaper article, we have checked back with the engine manufacturer, and through Mayor Dentlinger and water works superintendent, Harry Eisenhut. However, we can find nothing to justify a correction of the cost figures other than that indicating the comparison to be steam vs. Diesel pumping, rather than purchased power vs. Diesel power.

OPERATION AND MAINTENANCE OF TURBINE DEEP WELL PUMPING UNITS*

By JOSEPH D. CAMPBELL
Manager, Merchantsville-Penusauken Water Co., Merchantsville, N. J.

The Author

TO THE average layman inspecting a deep well pumping unit, it looks so simple that his first impression is that any unskilled person is capable of operating and maintaining it. However, no pumping unit is more apt to give serious trouble when neglected or improperly cared for than a deep well unit. To further substantiate this statement we, who are entrusted with the operation and maintenance of this equipment, know what would happen if a deep well turbine in operation, suddenly for one or many reasons stopped and, before allowing the water to return to its level in the well, during which it rotates the impellers in the opposite direction, an operator would quickly throw the starting switch. The result would be a sudden jar and, in all probability, the couplings on the pump shaft would be loosened in one or more places.

Motor Maintenance

In most installations the prime movers are electric induction motors and care should be exercised in maintaining them. The proper grade of oil should be used and the proper level maintained. Frequent oil changes should be made, depending upon the hours of operation. If a slip-ring type of motor is employed, the brushes should not bind in the brush holders and the springs should have an even tension. The commutator should be kept very clean and badly worn brushes should be replaced. A very fine grade of sand paper can be used for cleaning the commutator, but *in no case* should emery-paper be used for this purpose. When the commutator becomes worn or pitted the rotor of the motor should be disassembled, put in a cradle, and taken to a first class shop to have the commutator refaced. The main fuses and clips should be cleaned and checked periodically for pitting, and be replaced if necessary. The oil in the switch or dash-pot should be changed at least every three years. Switch or transformer oil should be stored in air-tight containers to exclude moisture. It is advisable, when the slightest doubt exists, to consult the manufacturer of the electric equipment, or your local power company, as to the proper flash point of the oil to be used for this purpose.

The motor should be cleaned frequently with a portable power blower. And the oil lines to the bearings of the motor should be tight to prevent oil from leaking onto the insulation.

Bearings Maintenance

On some installations the main radial thrust bearing, which carries the weight of the shaft and impellers of the pump, is on the top of the motor. However, in most installations here in southern New Jersey, the motor and the pump are connected by means of a flexible coupling. The coupling must be kept in perfect alignment and the leather or rubber bushings should be replaced when worn. The main bearing of the pump is a self-aligning ball type thrust-bearing, or else the tilting segment type. Either bearing performs the highly important task of carrying the weight of the entire shaft and impellers and is self-aligning.

The bearing with which the writer is most familiar is the Kingsbury. This is the tilting segment type of bearing, which consists of a flat upper plate resting on a lower plate cut into segments, and with the segments mounted to allow a slight tilt. As the bearing is immersed in oil, the upper plate draws a film of oil over each segment so that the whole plate rides on this film of oil with no metal-to-metal contact. The radial bearing is mounted in the same housing with the tilting segment thrust bearing, and automatic oil circulation is effected by the centrifugal action of the oil rotating with the bearing. A sight-feed oil gauge enables the operator to watch this automatic circulation. A cooling coil of copper tubing, with water circulating through it, keeps the lubricating oil at the proper temperature. The oil in this bearing should be changed at least twice a year, and the case flushed with a light flushing oil at least once a year. Each time the well pump is pulled for inspection or repairs this bearing should be carefully inspected and, if worn, should be returned to the factory for refacing, or other repairs and replacements. Few local machine shops are equipped or fitted to do a good refacing job, whereas, the factory is equipped and capable of doing a perfect job.

Water used for cooling the ball thrust or tilting segment type bearing, and for sealing the stuffing box, should be piped to the sewer or some convenient waste outlet. The health department will not permit this water to be returned to the well.

Glands and Packing

The packing on the top gland of the pump shaft should be changed at least once each year. If old packing is permitted to remain in service, it usually results in badly scored pump shafts.

Most operators prefer the oil or grease seal gland to the water seal gland, since the oil or grease is far more effective because it prevents oxidation and years of performance have proven that they are the ideal lubricants for packing and will have less tendency to score the shaft.

Frequency of Pump Pulling

One of the questions often asked by superintendents is: "How often should a deep well pump, which is apparently working satisfactorily, be pulled for inspection and repairs?" This question is rather a large order and depends largely on the hours of use and the kind of water pumped.

If the pump is in use 24 hours each day and the water pumped is not corrosive and the yield has not diminished, the pump should be pulled at least every two to three years. If the water is corrosive or the yield somewhat diminishes, it may be necessary to pull the well pump after each summer's run. One thing to remember is, that if you neglect the unit you may have one or more

*A paper presented before the New Jersey Section of the American Water Works Assn. Here published by permission of the Editor of the A. W. W. A. Journal.

units out of service for repairs simultaneously and, possibly, at the most critical time. After the well pumps have been pulled a careful inspection will reveal worn, weak or badly pitted parts such as the pump shaft, discharge pipe, couplings, bearings, main column, shaft couplings and impellers.

When the CO_2 content of the water pumped is above 15 parts per million and the pH value low (say from 5.2 to 6.2), the high CO_2 content will attack the gray iron impellers, generally loosening the key-way, and it usually pays to replace them with bronze impellers and install a stainless steel shaft.

When reassembling the unit, care should be exercised to see that everything fits properly. Clean threads on the couplings, bolts and nuts are essential for a tight, satisfactory installation. Extreme care should be exercised in cleaning all bearings and aligning the spiders, or spacers, between the discharge column and shaft tubing.

The main shaft adjusting nut should be carefully checked so that the impellers do not contact the pump bowl. In other words, a careful check will reveal whether or not you have the proper clearance.

Before the well unit is again installed, the drop pipe, oil tube, and pump bowls should be thoroughly scraped and cleaned. At least two coats of the best quality paint should be applied. Sufficient time should elapse between coats to allow for drying. The paint should be free from taste producing compounds.

In conclusion, I wish to state that, in the brief time allotted to me, I have not attempted to cover in detail the entire operation and maintenance, such as the trouble experienced when the well screen becomes worn or deteriorated and allows sand and gravel to come through, or when the well screen becomes clogged and the flow is diminished, or the work necessary in erecting the derrick and hoisting machine for pulling the well pump, or methods employed in keeping an accurate account of the static level and draw-down. Rather, I have attempted to cover only the essentials in actual operation and maintenance.

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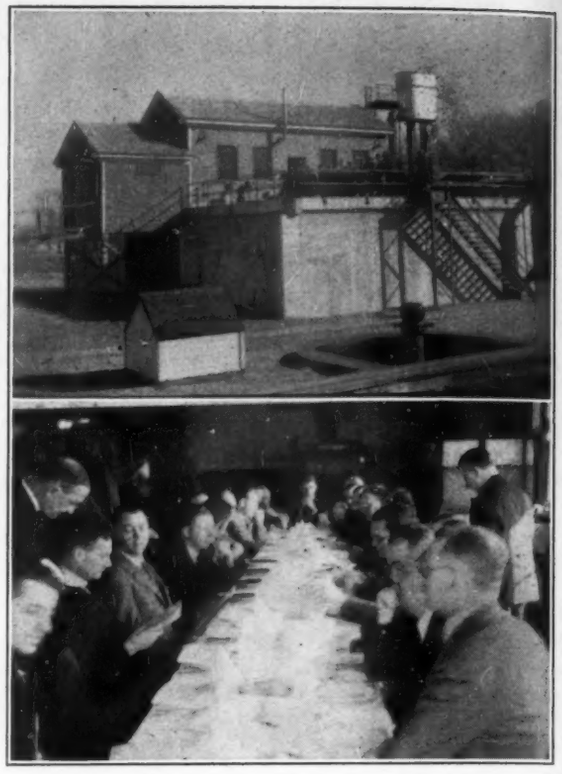
Filter Cleaning Demonstration

In the June 1937 issue of WATER WORKS AND SEWERAGE (p. 218) a digest of a paper by J. G. Patrick, Chemist of the West Virginia Pump and Paper Co., related something of a novel method of cleaning filter sand in place. The scheme, an invention of Mr. Patrick, involves treatment of the filter bed with liquid sulphur dioxide, added to the filter manifold while slowly filling the underdrains and sand bed with water through the manifold.

On December 4th, by invitation, a group of about 60 water works men, engineers, professors, editor and sulphur dioxide manufacturers were invited to observe a demonstration of the Patrick process at the Lynbrook plant of the Long Island Water Co., conducted by the inventor.

The problem was a severe test on the process, in that the sand and gravel was heavily coated with iron and manganese oxides from a well water supply. However, Mr. Patrick set to work and after adding sufficient liquid sulphur dioxide from an up-ended cylinder, to procure a 2 per cent solution of the gas in the calculated volume of water to fill the sand and gravel bed voids, the sulphurous solution was recirculated with a small centrifugal. After a 24 hour contact period, the Lynbrook filter figuratively "ran blood" at the inventor's hands, when back-washed. As one observer put it—"He had seen many filters in a variety of 'fixes,' but it was the first time he had ever seen a filter with its throat cut." So red was the wash water with dissociated red oxide of iron, it looked more like slaughter-house waste than dirty wash water. After the wash the glistening sand had the appearance of dark rubies or light garnets. The demonstration had proved as interesting as successful.



Group at the Lynbrook Plant Sees a Filter Run Blood. Also Group at the Luncheon Which Followed

Following the exhibition, many of those assembled were luncheon guests of the Industrial Chemical Sales Division of W. Va. Pulp and Paper Co., Colonel Jo. Wrench, presiding, called on Mr. Patrick to recount the history behind the development of the method and its successful adaptations to date. Other speakers responding were H. E. Jordan, Secretary of A.W.W.A.; Prof. Lewis Carpenter, N. Y. University; H. E. Bacon, representing S. T. Powell, Chem. Engr.; and Linn H. Enslow, Editor of WATER WORKS AND SEWERAGE.

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New York's $30,000,000 Sewage Plant in Operation

The Ward's Island Activated Sludge Plant, the largest in a program of 38 treatment plants for treating the sewage of the metropolitan area of New York City, is now in operation. The plant, which was put under construction in 1931, laid only partially built during the depression, until 1935 when Mayor LaGuardia secured Public Works Administrator Ickes' approval of a $25,000,000 loan and grant for its completion. The Ward's Island Plant is designed to handle 190 m.g.d. of sewage from upper Manhattan and the Bronx, to relieve the East River. Its cost to date is $30,000,000.

Additional plants, to be constructed, will cost an estimated $170,000,000 more. The first (1935) was the Coney Island Chemical Treatment Plant (now being enlarged); the third (now under construction), the Talman's Island Plant; the fourth (ready for bids), the Jamaica Bay Plant; the fifth (under design), the 26th Ward (Jamaica Bay) Plant.

SOME OPERATING KINKS*

By A. R. TODD
Chemist, Wheeling Water Works, Wheeling, W. Va.

The Author

AT WHEELING we have a 20 mgd. rapid sand filtration plant, the source of supply being the Ohio River. The raw water varies from an acid condition of 9 ppm. to an alkaline condition of 15 ppm.; the turbidity from 5 to 1,450 parts. Some one has stated that during extremely dry weather that 1 gal. out of every 4 in the Ohio River passing our plant has been through some city sewerage system. Sewage, acid mine water and trade wastes make a water at times exceedingly difficult to treat, and at other times very easy to treat. In other words, if conditions are just right, we have a natural coagulation from the iron sulphate, in the mine water, precipitated by the natural alkalinity of the river. At such times it is only necessary to add a small amount of lime for corrective treatment. Chemical examinations of the Ohio River water have shown at one or another time the presence of most of the elements found in chemistry books—zinc, tin and iron sulphates and chlorides from the pickling operations at the tin mill plants, copper and iron, nitrites and nitrates from alloy plants. In addition we have manganese, magnesium, and many other elements together with phenols, creosols and napthalene.

Purification Process

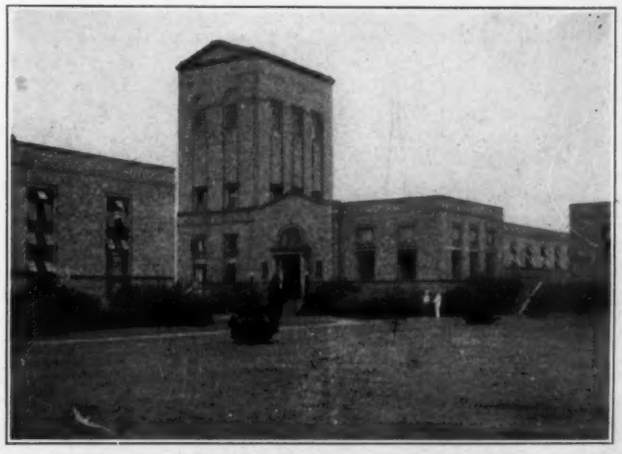
Since the river at most times contains sufficient iron sulphate, we find it only necessary to use lime to get perfect coagulation. When the river water contains none or very little iron sulphate, we add iron sulphate in sufficient quantities to amount to 0.1 gr. per gal. for each 100 parts per million of turbidity. In using the various materials in water treatment we have found that 2 lbs. of carbon per mg., applied to water just as it is going on the filters, is as effective as 14 lbs. per mg. applied to the raw water; that is, in so far as tastes and odor removal is concerned. Also that 2.8 lbs. of chlorine per mg. if applied to the finished water, is as effective as 7.8 lbs. applied as prechlorination; that is, in so far as sterilization is concerned.

From November, 1933, to November, 1936, our purification process consisted of first adding ferrous sulphate, if there wasn't sufficient in the river water, then the lime. We operate our settling basins in tandem and we added ammonia water just as the water left the 1st basin. (We use aqua ammonia instead of anhydrous because aqua ammonia contains about 33% ammonia and costs 3 cts. per lb. delivered, while anhydrous costs us 17½ cts. per lb. delivered.) Then we added chlorine just as the water was coming into the 2nd basin, then post-chlorinated as a precautionary measure, using ¼ to ½ lb. chlorine per million gallons. This method gave us fairly good results. Our filter runs averaged 70 hours, our wash water less than 1½ per cent. The sand remained in good shape, but we did have six periods of from one to three days of taste and odor trouble. About the first of November, 1936, we had a raw river condition so bad that people living near the aerators complained of the odor. From April until this time—some seven months—the water had been acid, then the water changed to the alkaline side. Evidently the change from acid to alkaline affected the animal life of the river, but would not account for the phenols, creosols and naphthalene. We took some naphthalene, put it in distilled water, shook well, and allowed it to stand 24 hours. This gave us a saturated solution of naphthalene in water. By taking 100 cc of this solution and diluting it with 100 cc of water, we got a 50 per cent saturation. This compared exactly to the river water. This naphthalene and distilled water test gave us an idea—in fact, two of them. We made dilutions of 1 to 2; 1 to 4; 1 to 8; 1 to 16; 1 to 32; 1 to 64; 1 to 128; 1 to 256, and tried them out on our various employees. We found that out of 12 people, nine detected the 1 to 64, two people the 1 to 32, 1 to 128. So now we have a basis of knowing just how good our nose is. In other words we have a universal standard. If you don't have any naphthalene in the laboratory, take some moth balls from home.

Oxidation vs. Medication

The second idea was right in front of our nose and we couldn't see it. When the river water was acid we had no trouble with tastes or odors; when it turned alkaline we did. We took 60 gms. phenol, dissolved it in 2,000 ml distilled water, divided it into 2 parts. To one part we added ferrous sulphate; to the other part some lime. Then we passed chlorine gas in these solutions.

Now, here is the answer: In the one containing lime plus phenol—at first, a resinous product formed, then a heavier liquid settled out and an odor developed that was anything but pleasant. A little of this resin floated in water and gave all the characteristics of water with the medicated odor or taste. Now, the other sample containing the ferrous sulphate gave an entirely different effect. There was no resin produced or bad odor, but instead a rather pleasant, faint perfume-like odor. We then made up various solutions using raw water



The Filter Plant, Wheeling, W. Va.

*This paper was read before the Central States Section of A. W. W. A. It is presented here by permission of the Editor of the Association.

with phenol concentrations of from 1 to 10,000 to 1 to 1,000,000, with pH's of 3.8, 4.4, 5.0, 5.5, 6, 6.5, and 7.2. We then introduced a solution containing ferrous sulphate with chlorine, shook it well, and allowed it to stand only ten minutes for oxidation. Then lime water was added to bring the pH up to 9.3. The solutions were then filtered and tested for odor and taste. In all of the solutions from a pH of 3.8 to 5.5, no odor or taste could be detected. But at a pH of 6 to 7.2, the characteristic medicated odor and taste developed.

To make a long story short, it appears that raw water containing phenols, creosols or naphthalene, can be effectively treated with ferrous sulphate and chlorine at a pH of 5.5 or under, and will not develop the characteristic taste when lime is added *afterwards*.

Plant Practice

The best method we have found to accomplish this is to feed ferrous sulphate and chlorine together. Now, for producing chlorinated-copperas you feed 1 lb. chlorine to 7.8 lbs. ferrous sulphate, but this isn't what is needed to oxidize phenols. You want the ferrous sulphate to act as a carrier or possibly a catalytic agent. In fact, it is used as such in oxidizing organic compounds with chlorine.

The ferrous sulphate answers three purposes: 1st, as a coagulant; 2nd, it lowers the pH of the raw water; 3rd, as the carrier for the chlorine. So instead of feeding 1 lb. of chlorine to every 7.8 lbs. of ferrous sulphate as when making chlorinated-copperas, we only feed 1½ lbs. of chlorine per million gallons of water, regardless of the amount of ferrous sulphate required for coagulation or in bringing the pH down.

Since last November this combination of copperas with chlorine has been our purification process. Then, 15 minutes after the ferrous sulphate and chlorine is added, lime is added to bring the pH up to 9.3. Then in order to keep the filters in good shape, another lb. of chlorine per million gallons is fed just as the water goes on the filters. This method cured our taste troubles last November and has been most successful to date.

Low Temperature Results

Last winter we had 44 days when the raw water was at its maximum density and usually hardest to coagulate satisfactorily. We experienced no difficulties, whatever, in getting the floc to form and settle out. We attribute this to the fact that we were feeding ferrous sulphate and chlorine together. During this time, the raw water varied in turbidity from 20 to 475 ppm., and the water coming over on top of the filters showed a turbidity of only 3 ppm. or less. During previous winters, when the water reached the temperature of 39° F., we invariably had trouble with floc not settling properly in the basins, and coming on the filters; evidently, there is a difference in specific gravity of the floc secured with the partially oxidized (chlorinated) copperas.

Troubles with the Residual Chlorine Test

Occasionally we get raw water in Wheeling that is high in nitrites along with the iron and manganese. In making the orthotolidin test for chlorine we can at times get a test on the raw water equivalent to 0.5 parts of chlorine per million gallons, and this condition will persist all through the plant. In fact, at such times you can set aside such water for weeks, and still get a test. When you have nitrites of from 2 to 4 parts per million, your ordinary tests for chlorine with orthotolidin or potassium iodide and starch is absolutely worthless, whether in the light or dark, or any other condition mentioned in the literature. So the separation of chlorine, nitrites, iron and manganese, and cobalt, offers some difficulty.

The orthotolidin test solution is made up with hydrochloric acid. I had an idea that perhaps the manganese, when precipitated as the hydroside was converted to the oxide and thereby liberated chlorine from the hydrochloric acid. This was an erroneous idea, as orthotolidin solutions were made up using instead of hydrochloric acid, acetic acid or phosphoric acid, and the results were the same. We also found that you cannot filter water before making the orthotolidin test for chlorine filter paper or cotton takes out the chlorine.

In the presence of a high nitrite, iron, and manganese, there is only one sure method of knowing whether the color developed is chlorine, and that is to rig up a small all-glass still. All of the chlorine comes over in the first 60 ml., so the method is to take 100 ml. of the water, place it in the still and collect the distillate in a tube containing 1 cc of the orthotolidin solution, and 39 ml. distilled water. Your chlorine recovery is 60 per cent with 0.1 part per million chlorine. If you get a test showing 0.06 ppm. chlorine you know you had 0.1 to begin with. Or, if you wish, you can take the reading of the distillate on each successive 10 ml. portion, and from this you can work out your own table.

Salting Down Dirty Filters

Now, regarding the filter beds. If your sand is in bad shape, don't try to prechlorinate. If you do you will have plenty of grief unless you start out with not over ¼ lb. of chlorine per million gallons, and gradually build it up, expecting to take at least four months before getting chlorine through the filters. [This statement also applies to bringing up the pH for corrosion control. You will have plenty of trouble due to sloughing off of the iron oxide in your mains, causing red water, if you try to bring the pH up too rapidly.]

If your filters are slimy due to organic matter, try using ordinary common salt, not less than 1½ lbs. to the square foot. Place this on the sand while still submerged under a few inches of water, then lower the water to the sand level and let stand 24 hours, then give a good wash. You will be surprised at the results. In fact, you will find it more effective than a sodium hydroxide treatment. You know the sardine canners use salt water instead of fresh water in washing the fish because it is so much more effective in removing the slime.

The high velocity wash still leaves us with filter troubles, as we have all experienced. The best method we have found to remove the hard spots and mud balls is to take either a ¾-in. hose attached to a 7-ft. length of 1-in. pipe at the end. Instead of a nozzle, use a cap, in which a ½-in. hole has been drilled, under 90 to 100 lbs. pressure; this gives plenty of water and the jet will not disturb the gravel. One man can get over a 712 sq. ft. filter in about two hours. We find that, in addition to the salt treatment, doing this twice a year keeps the beds in good shape. We also have experienced increased filter runs.

We boost our finished water pH up to 9.3 even though the marble test indicates 8.8 to be the correct point. And the reasons are these: First, no complaints on red water except a few dead ends ending up a hillside. Second, at 9.3 the water remains at 9.3 all over town. Third, by actual tests, at 9.3 less iron is dissolved from iron filings than at any other pH value adjustment on the Wheeling water.

Electrolysis and Grounding

Now regarding electrolysis, I venture to say that this is the cause of most of our red water trouble. I refer to stray ground currents and, worst of all, grounding on

our pipe lines. Summer before last we had a number of complaints from an area about three blocks square in one of the better sections of the city. The hydrants were blown repeatedly and still complaints—so we went out and tested the pipe for stray currents. We found a flow of two milivolts going into the pipe. Then a street car passed and it went up to 50 milivolts. In order to find out just what was happening to the water, we flushed the pipes and then took samples every two hours for 24 hours and noted what happened:

Analysis (p.p.m.)	*Water at start*	*At 24 hours*
Iron	none	5
pH	9.3	7.8
Phenolphthalen alk.	6	0
Carbon Dioxide	0	6
Total Alkalinity	22	15

Now, to prove the stray currents responsible, we set up an apparatus in the laboratory using D. C. current, ran tests using from ½ milivolt to 45 volts with the same results—the higher the current the quicker the results. We then went down to the back end of the filter gallery. This gave us about 150 feet of pipe to work on. We attached one of the wires here and the other in the laboratory. Water in this pipe behaved just the same. Then we knew that A. C. current would have no effect (at least that's what someone told us), so, we tried it out anyway. Very much to our chagrin and surprise, we got the same results. Now we don't have to worry about the effect on the mains, because of the small quantity of iron going into solution. But those of us responsible for the quality of water should protest any kind of grounding on the water pipes.

Bacteria and pH

Bacterial conditions of the raw Ohio River water at the Warwood plant—the plate count varies from 0 to 24,000; b. Coli from 0 to 1,000 per ml. The plate count varies almost directly with the pH from 3.8 to 5.0. The count varies from 0 to 400 with an average of 80. At a pH from 5.0 to 5.5 the count varies from 100 to 800 with an average of 140. At a pH of from 5.5 to 7.2 the count will jump from 1,000 to 24,000 with an average of 2,000.

Laboratory Work

In addition to our regular work, our laboratory takes care of the city and county Board of Health. Most of this work is routine, such as milk, well water samples, etc. About a year ago the Health Commissioner decided that he wanted to know just how sanitary the spoons, forks, water glasses, beer glasses, and ice cream dippers were. So, since then we have made several hundred tests. The first lot of samples received showed plate counts as high as 200,000 on beer glasses, and 1,000,000 on ice cream dippers. Spoons and knives had from 0 to 2,000; forks from 10 to 10,000. Incidentally, the common eating fork lacks much to be desired as a sanitary eating utensil. Also, what we would term the better class restaurants and beer places showed the best results, and the so-called night clubs the worst.

The method that we use might be of interest to you. We prepare in the laboratory the swabs for taking the samples. We use a medium size test tube, introduce the swab, close the end with a cotton plug, and sterilize. Before the tube with the swab leaves the laboratory, we add ½ ml. of sterilized salt, made by dissolving 8.3 grams sodium chloride in one liter of water, and sterilize. The inspectors take these swabs, and on a beer glass, they pass the swab once around the rim of the glass, on both the inside and outside. When the tubes are returned to the laboratory, an additional 3½ ml. of the sterilized salt solution is added to each tube. The tube is then well shaken and 1 ml. plated in the usual way, and incubated at 37 for 48 hours.

Molds

The past winter, as you all recall, was a mild one, but I don't know whether or not this would account for the new trouble we experienced at the Wheeling plant, in the contamination of the raw river water with mold spores. Counts of 100 per ml. were not uncommon. We found it necessary to make at least five plates per dilution on the raw water, in order to get a plate free from mold, so as to get an accurate plate count. If the mold count ran five per ml. or less, we had no difficulty with the coagulated plate counts; if over this, we did, and when the plate counts were running over 100 per ml. molds, we had on three separate occasions a mold count in the finished tap water, notwithstanding the fact that we were chlorinating at three separate points; that is, pre-chlorination, intermediate chlorination, and post chlorination. There appeared to be three separate kinds, one that simply covered the plate in all directions, another that formed an inverted cone which is a thing of rare beauty, and the third simply formed large colonies.

Carbon Treatment

Large quantities of gasoline are towed up and down the Ohio River. Last winter one of these boats got loose, and rammed a bridge pier, and the gasoline covered the water at our intake pier. The water coming into the plant had a very strong odor of gasoline. Four pounds of activated carbon per million gals. completely removed this odor. In a small city near Wheeling, they atttempted to use an old oil pipe line for conveying water, and had all kinds of complaints that the water had kerosene taste. I advised four pounds of carbon per million gals. and this was a complete success. I am merely citing these experiences so if you ever have these troubles, you may know what to do.

A water works chemist, during the day, wages a constant battle to remove all the iron and manganese from the water, and hesitates in the use of copper sulphate for algae. In the evening he reads that in one section of Florida, large quantities of manganese are needed as a fertilizer. In an advertisement we read that eleven chemicals—iron, sulphur, phosphorus, boron, nitrogen, magnesium, manganese, copper, calcium, silicon and potassium—are needed in our gardens to produce perfect plants. Also, young chicks will not develop, but on the contrary will grow anemic, and die, without small amounts of manganese, and that traces of copper in some form will cure anemia in the human being. The physician prescribes organic iron salts, and certainly there are organic salts of iron in the Ohio River. There is also nickel, and occasionally traces of cobalt are present, and many other inorganic and organic chemicals.

So, sometimes we wonder, aside from being clear and sterile, just how pure a drinking water should be.

Summary

Phenols and other taste and odor producing compounds can be successfully eliminated by the use of ferrous sulphate and chlorine at pH of 5.5 or under.

Common ordinary salt was found more effective than sodium hydroxide in removing slime and other organic matter from filter beds.

Electrolysis, due to stray currents and also grounding on water mains, is a major cause of red water troubles.

When prechlorinating, raw water troubles arise in making chlorine tests—also in the presence of heavy nitrites. Filter paper or cotton, in filtering, removes chlorine. The only satisfactory method found was to distill off the chlorine and catch it in orthotolidin treated distilled water.

Water Works and Sewerage—December, 1937

GEORGIA'S WATER AND SEWAGE SCHOOL

Rates Editorial Recognition—Gets It!

*"A WATER WORKS SCHOOL"**

"The Georgia Water and Sewage Plant Operators' School, which opened November 3 for a four-day session at Georgia Tech, is significant of a new trend in education and a new spirit in public service. The students in this school will be the personnel of the water works and sewage plants of the municipalities and industrial towns of Georgia. They will study and discuss such matters as water purification, laboratory tests and experiments, plant inspection, water distribution, the construction, maintenance and operation of sewer systems, the management and hygiene of swimming pools, and the protection of water sheds. The courses are divided into elementary subjects, for operators with limited training, and advanced subjects for those of riper knowledge and experience. The teaching will be largely by demonstrations, though there will be plenty of lectures and round-table discussions.

Conducted by the Sanitary and Engineering Division of the State Department of Public Health, with the generous assistance of the Georgia School of Technology and the Georgia Water and Sewage Plant Operators' Association, this school is of vital value to the state and to each of the communities represented. It enables the operators of the water supply and sanitary systems of the smaller as well as the larger towns to keep abreast of scientific and technological progress in their important field of public service. It means much to Georgia's welfare that her educational and civic leaders are co-operating in such a cause.

**An editorial from the Atlanta Journal.*

*[Congratulations to the Georgians; thanks and high appreciation to the "Atlanta Journal," in behalf of "all of us."—*ED.*]*

THE Sixth Annual Georgia Water and Sewerage School sponsored by the Georgia Department of Health, the Georgia Water Works and Sewage Operators Association, and the Georgia School of Technology, was held in Atlanta, November 3-6. The attendance at the school was 205, of which 85 per cent represented municipal plants.

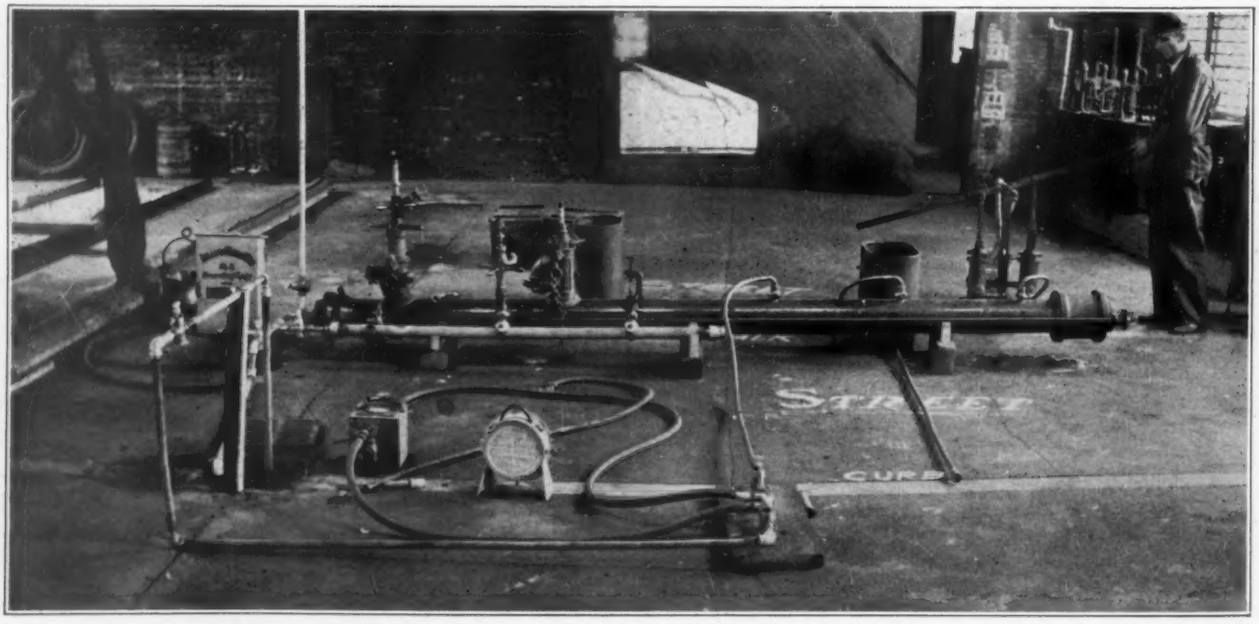
Classroom and laboratory work was given in both basic and advanced subjects. The entire group was divided into two sections. The basic section received individual instruction and practice in chemical and bacteriological laboratory technique; each squad in this section using a complete set of apparatus required in the routine operation of a water purification plant. For the advanced section panel discussions and demonstrations were arranged.

All classroom and laboratory sessions were held in the Biology Department of the Georgia School of Technology. The Distribution Service and Meter Department of the Atlanta Water Works was made available for field instructions in water distribution practice. Two of the new Atlanta sewage treatment plants were used for observation of sewage treatment methods.

Dr. M. L. Brittain, president, Georgia School of Technology, and Dr. T. F. Abercrombie, director, Georgia Department of Public Health, came to open the school with a "welcome."

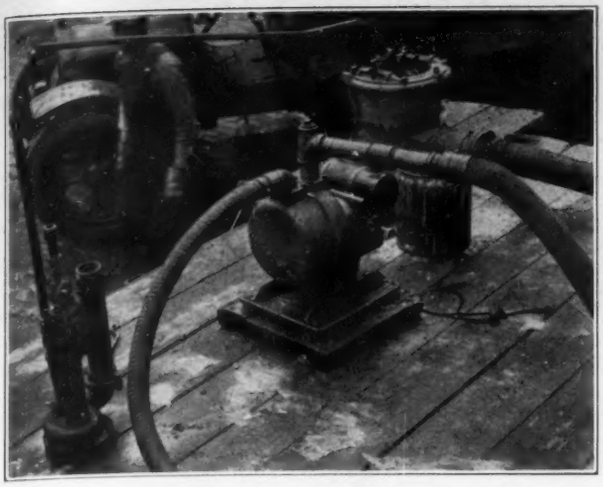
Georgia's Progress

"The Status of Water and Sewage Treatment in Georgia," was outlined by W. H. Weir, Georgia Department of Public Health. Progress during the past ten years was revealed by naming the more important water and sewerage projects completed. The need for continuing the present rate of improvement was illustrated by maps showing where existing deficiencies existed. Detailed steps which a municipal-



Set-up to Demonstrate Various Steps in Making Taps, Etc.

Rear Pipe—(Left to right) Mueller, Dean and Atlanta Tapping Machines; Service Connections (Far and Near), Hydro Test-Pump. (2 In. Pipe in Front.) Weld Closure of Former Connection; Strapped-On Saddle Connection with Corporation Cocks. (Foreground) Standard Test Meter (Square); 30 Minute Pressure Recording Gauge (Round). (Left Rear) 24-Hour Pressure and Flow Recording Gauge.



Emergency and Service Pumps

Left to Right: Compressed Air Driven Centrifugal; Gas Engine Driven Utility Pump; Bilge Pump, with the "Elbow Grease" Missing. The Air Compressor Truck Is Visible in Background.

ity must take in the legal, the engineering, and the financing of a water or sewerage project were set forth. The purpose of the School was defined. Its effect in bringing about better operation, an improved civic position for the water and sewerage official, and in focusing public attention on his problems and worth to the community were amongst the purposes.

Two motion pictures were shown, **"Micro-Movies,"** prepared by John B. Hawley, Consulting Engineer, Fort Worth, Texas, was commented upon by Prof. H. A. Wyckoff. This brought to the screen many excellent views of micro-organisms in motion as would be seen through the microscope. **"Behind the Water Front,"** depicting the history and operation of the Indianapolis Water Works, was made available through the courtesy of the Indianapolis Water Company. It proved an outstanding example of a method of "selling" the local water works to the public. Considerable of the picture was in color to add interest.

Laboratory Work

Special instruction for the basic group was begun by W. H. Weir, in an illustrated talk on methods of treating surface and underground waters. Large flow sheet diagrams on wall charts and model of rapid sand filter were used.

Following this elementary introduction to plant processes, Professor H. A. Wyckoff took over the classes for laboratory work in bacteriological testing of water and sewage. The work was done by the "students." Another group received laboratory instruction and practice in making turbidity, alkalinity, carbon dioxide, and residual chlorine determinations; and also coagulation tests, using a battery of stirring machines. The plant control laboratory instruction was given by N. M. de Jarnette and G. R. Frith, of the State Department of Health. To the advanced groups were given methods for determining iron, hardness, free alum, chlorine and chloramines in the presence of interfering substances. Samples of water brought to the school by the operators were in most instances used in this demonstration.

Miscellany

One morning session consisted of a panel discussion of water supply problems. Mr. W. J. Whaley, Supt. of Water, Winder, related his experience in minimizing corrosion in a very soft surface supply. The accurate measurement of odors was demonstrated by Paul Weir, Supt. of Filtration, Atlanta. Clark W. Jones, Supt. of Water, Dalton, assisted by Carl V. Hancock, exhibited samples of mud-balls in filter sand, due to manganese, and illustrated cleaning methods. Lewis Simonton, Supt. of Filtration, Griffin, told how he keeps his filter plant at maximum efficiency by care and routine checking of all equipment and control mechanisms. A detailed explanation of record keeping at Macon, by Supt. T. E. P. Woodward, covered steam turbine pumping station, filtration plant, and laboratory reports and a file of card maps of street intersections for the entire distribution system.

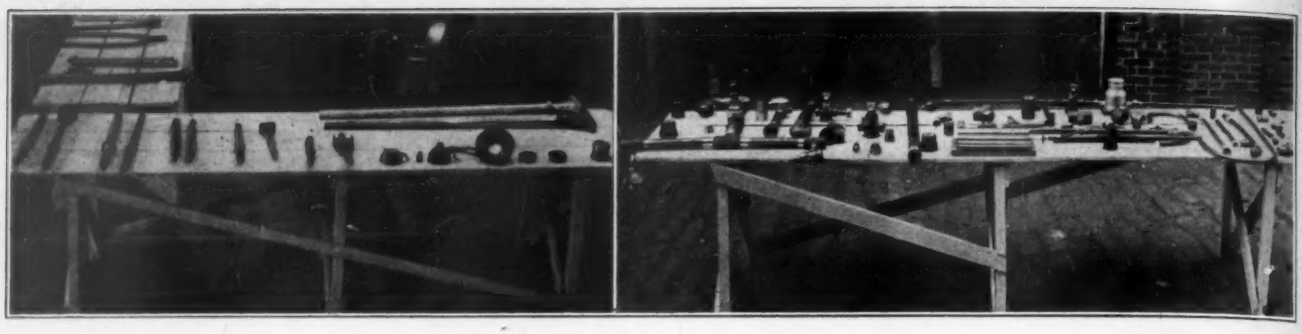
Rapp Demonstrations a High-Light

The outstanding feature of the school was an afternoon spent in the Pipe and Service Meter Shop of the Atlanta Water Department. For this period W. M. Rapp (honorary member A. W. W. A.), Atlanta Supt. of Distribution, assembled material and equipment used in distributing water in Atlanta. During his more than fifty years of continuous service in the Atlanta Water Department Mr. Rapp has developed many time and labor-saving devices and methods useful in distribution practice. Under his supervision the personnel of his department went through the working process, simulating problems encountered on the job under both day and night conditions. Cutting mains, tapping, service connections, pipe jointing and calking, trench dewatering, meter setting, testing and repairs and night construction illumination, were typical of the items demonstrated. This display of equipment (some of which is here pictured) and persons routinely performing these duties, were available for individual observation during the entire period of the school. The wealth of material displayed, and the actual operation of it, provided instruction seldom made available to water works schools. To "Professor" Rapp, a big hand and a vote of appreciation.

A second panel discussion of operation experiences occupied another morning session. **"Maintenance of Pumps,"** by W. L. Huckeba, Supt. of Filtr., Carrollton, and **"Pump Efficiency Testing,"** by LOWELL CADY of Wiedeman & Singleton, Atlanta, consulting engineer, initiated a lively discussion. **"Cross-Connections"** were discussed by O. R. Harvey, from prepared material by Supt. A. J. Smalshaf of Columbus. Experiences in locating plumbing interconnections in buildings were related by L. G. Lenert, Georgia Department of Public Health. Coagulation of turbid water with different coagulants, and the effect of various floc-

Plugs and Sleeves

Front Row: Rapp's Sewer Plugs for Closing Dead-Ended Pipe; "Atlanta" Split Sleeve. Back Row: "Atlanta" Split Sleeve; Adjustable Height Valve Boxes; Screw Plug with Blow Off, on Line Extension Valve.



Display of Parts and Fittings

(Left Table): Valve Stem Blanks in the Rough and as Finished in Atlanta Water Dept. Shops; Hydrant Caps with Broken Nubs and After Repairing by Welding. (Right Table): "Stream Line" Fittings, Copper Pipe and Tubing, Etc., Used in House Service Work and Meter Installations.

culation equipment at the water purification plant of the Tubize Chatillon Corporation at Rome, was discussed by Carl Alexander, Supt. of Filtration (retiring President of the Georgia Water and Sewage Works Operators Assn.), who illustrated methods found economical in this typical plant. Dr. Wm. Stericker, Development Chemist, Philadelphia Quartz Company, reviewed "Recent Developments in the Use of Silica as an Aid in Coagulation." Sterilization of water and mains at Thomasville was discussed by O. W. Gray, Plant Operator. Experiences in emergency sterilization of water supplies during the Ohio River flood were related by L. W. de Jarnette.

Sewerage Inspection

The tour of inspection of sewage treatment plants of the City of Atlanta included South River and Intrenchment Creek Plants. Both of these new plants were in operation and revealed several basic processes of sewage treatment and a great amount of mechanical equipment in this field. During this tour W. A. Hansell, Assistant Chief of Construction, City of Atlanta, demonstrated methods of sewer construction including jointing, root elimination, house connections to sewers and repairs. These were actual working demonstrations using personnel of the Construction Department, regularly doing this work in Atlanta.

The operation of various types of sewage treatment plants was covered in a classroom lecture by G. R. Frith. In this he showed the evolution of sewage treatment from the septic tank to the modern sewage plant, developing the subject by wall chart flow sheets. Simple operation procedures applicable to each type of plant were explained.

Banquet and Awards

A banquet on the roof garden of the Atlantan Hotel given by the Paper Makers Division, Hercules Powder Company, provided the occasion for the business session of the Georgia Water Works and Sewage Operators Association. Methods of water and sewage treatment in Europe, was the subject of a talk by Dr. F. C. Snow, Civil Engineering Department, Georgia School of Technology. A memorial service for F. J. MacMullin, host on this occasion in previous years, was held. Awards for meritorious service in plant operation and local accomplishment were made to Supt. W. J. Whaley, Winder; B. P. Robertson, Villa Rica, and Geo. C. Roberts, Macon.

New Officers

The following were elected officers of the association for the new year: President, Lewis Simonton, Griffin; Vice President, L. L. Jacobs, Newman; Vice President, Clark W. Jones, Dalton; Secretary-Treasurer, Paul Weir, Atlanta.

Thirty operators attended the school for the first time this year. Twenty-five of these "freshmen" took the examination, looking to receiving the first grade of certification—Class C. Fifteen Class B and five Class A examinations were taken by operators having previously attended the school and holding Class B or Class C certificates. A new feature this year was a Gadget Display which included a number of useful devices, equipment and models.

As a blanket award to those putting in the four days of school work, the entire group attended the Clemson-Georgia Tech football game as guests of President Brittain.

[For the clear photographs used in illustrating this report, we are indebted to J. N. Eley, consulting engineer, of Atlanta.—ED.]

▼

Elected Officers of A.P.W.A.

Pictured, are the new officers of the American Public Works Association. They were elected at the recent Atlanta Convention:

President—J. E. Root, Cincinnati (center).
Vice-President—Guy Brown, St. Louis (left).
Vice-President—J. S. Flockhart, Newark, N. J. (right).
Treasurer—Roy L. Phillips, Meadville, Pa. (standing).
(All are Public Works Directors in their respective cities.)

The Editor's Comments

Dear Santa Claus

Dear Santa Claus:

Last year at this time we wrote you an open letter on this page, asking for a few things which we believed would benefit many of our readers and the water works and sewerage profession at large. For some of the things that we hoped might come to pass, and have, we are most thankful.

Particularly do we express thanks for the strides made (and being made) by the American Water Works Association since our 1936 letter. We refer to the progress made since the reorganization of the Association under its new and energizing executive secretary, Harry E. Jordan; the leadership of past presidents Frank Barbour and W. W. Hurlbut, and "full steam ahead" President Eugene Dugger; the work of the executive committee composed of real A.W.W.A. "wheel-horses." When we asked you to help A.W.W.A. grow in numbers and strength, little did we think that an all-time record increase in new members would be realized during 1937. Dear Santa Claus, we thank you from the bottom of our hearts for the more than 500 new members coming into A.W.W.A. during the first 11 months of 1937. And for those moves taken by individual associations asking or planning affiliation with A.W.W.A. as new state sections, we are also thankful. To those members of A.W.W.A. who have brought in the largest numbers of new members, to win the appellation "No. 1 A.W.W.A. Salesmen," we extend our congratulations.

Dear Santa, may we hope for like progress in another association which serves a smaller but important territory; an organization older than A.W.W.A.; one which has contributed so much of value to the water works profession; one which for many years has contributed to advancements far beyond its territorial area and its membership. We refer to the New England Water Works Association.

Last year we did not ask aid for this association, because it has always been more adequately appreciated and supported by water works men within the territory served, and well beyond. For this omission we were taken to task. We were shown that many men needful of the potential values of this worthy association, and residing in its territory, needed more "selling" on its value to the individual as much as to the water utility. So, dear Santa, if you will ask some of the many who know to show these operators what N.E.W.W.A. has done and is doing for its members, (in particular those who attend its conventions and its productive and inspiring monthly winter meetings), much of benefit to all concerned will result.

And, dear Santa, may we ask that you do for the sewage works man as much as for the water works man. Help him, too, to realize the benefits of becoming a member of one of the several member associations comprising the growing American Federation of Sewage Works Associations. [We must admit, though, that the growth of sewage associations has not been commensurate with the proven value of these sectional associations, and the Sewage Works Journal, to operators, engineers and the profession at large.] Please, Santa, show the sewage works association how to do what A.W.W.A. is doing.

For other developments of 1937, for which we appealed to you last year, we are also thankful, dear Santa. We refer to progress made in water and sewage works operator certification and licensing, notably in Ohio, New York, South Carolina, Georgia and elsewhere. It is becoming more evident, all the time, that this system of operator advancement is to prove an all important development in attaining operator protection against political interferences; better operators and more efficient operation; higher appreciation by the public at large; more stability of employment and more commensurate remuneration. We are also thankful for the developments in the direction of old age and disability benefits being provided by political subdivisions for the protection of municipal employees, not now covered in the Federal social security program.

Dear Santa Claus, some of the things we asked for last year we believe are worthy of repeating again this year—and, every year. We still hope for more politicians and public office holders who have sufficient sense of good judgment, to realize that the water works utility, above all other municipal enterprises cannot be used as a political football. Make the office holder realize, Santa Claus, that the water works must be no political "Christmas Tree" from which he can pluck "presents" for the local butcher, baker and candlestick maker, who comes "well recommended."

Give us cleaner streams, Santa, by making of industrial waste treatment a technical matter, based on need rather than on argued expediency, involving commercial (profit-and-loss) banter. Help us to defeat postponement through political influence; help us to overcome the retarding effect—the lack of uniformity in pollution control from state to state. Give us a much needed stream regulatory act of nation wide application with Federal backing and assistance.

Dear Santa, one of our chief requests is a higher and growing realization on the part of John Q. Public of the true value of the water works utility to his community—to him personally, and to his loved ones. That he will do a little private investigating to learn how very dependent he and his family is on the water works manager and his conscientious staff, when it comes to the most essential and important commodity in the life of a community—a wholesome, safe and reliable supply of pure water. Let him realize that he depends upon a service which cannot permit the least of let-downs or even an *occasional* failure. We ask that Mr. John Q. Public take a glance at the salaries paid from his town's treasury to various city officials, and consider whether more of his water rent or tax dollar should not go to these men responsible for management and operation of the community's No. 1 utility. We urge you to ask him to compare water works salaries with those paid for the city's legal services and to other municipal officials carrying far less responsibility than the water works manager. We ask that he compare the remuneration of the water utility manager and his assistants, with managers in charge of industrial plants representing the same approximate invested value, or managers having similar responsibilities. If he does this, we believe that Mr. John Q. Public will feel it his duty to bring organized effort into the city council to more equitably compensate the local water works personnel.

And, Santa Claus, send us more local editors who will take a higher interest in the water and sewage utilities and do the job, that can be so effectively done through the local press, of bringing the value of these public enterprises and their operating organizations to the deserved attention of the public. We also hope that you will help the managers of these utilities to become more "public relations" and publicity minded, not alone for their own good, but out of consideration for employees under them who will benefit therefrom.

EQUIPMENT NEWS

Gifford-Harding Pipe Thawing Machine

The Gifford-Harding Pipe Thawing Machine is not new. However, it has never been accorded any space in these columns and, to many of our readers, this announcement will have news value.

Gifford Harding Pipe Thawing Machine

Developed by Frank J. Gifford, long time New England water works superintendent and pioneer in electric thawing, the readily portable machine operates from the ordinary house connection providing 110 volt A.C. 60 cycle current. Featured is the effective but "non-inflaming" heat generated from a selective range of voltages to force current-flow as required. The voltage range is 9 to 18 and current flows 300 to 360 amperes. In addition to simplicity, it has the advantage of being reasonably priced.

For more detailed description, prices and list of satisfied users a leaflet is available. Address Gifford-Harding Co., Dedham, Mass.

▼

New Heat Control Valve for Sludge Gas Boilers

American Gas Products Corp. (Div. of American Radiator Corp), New York City, are offering a new and radically improved type of gas control valve, especially adaptable to IDEAL Gas Boilers now widely used in sewage treatment plants.

Known as No. 566 "Thermotor Gas Valve," the new valve automatically provides: (1) Thermostat, aquastat or pressurestat control of temperature and/or pressure; (2) a safety pilot; (3) automatic throttling control of flame; low water cut off for steam boilers—plus other features. It also provides safe manual control, operated independently of electric circuits.

This valve, which employs the same proven vapor tension principle, has a flexible diaphragm of especially compounded "Neoprene," eliminating the need for stem packing. It is unique in providing gas throttling and limit control, to maintain pre-determined boiler or heater conditions—*always* with a partially opened valve position, automatically varied in graduations up and down. As a safety measure, the valve is designed to close tight with snap action, should control range be exceeded for any reason. In addition, the valve is complete, in that hand shut-off is incorporated as an integral part to preclude need for an extra valve in the assembly.

For illustrated descriptive literature on this most modern of gas boiler control valves, "No. 566 Thermotor Valve," write American Gas Products Corp., 40 West 40th St., New York City.

No. 566 "Thermotor Gas Valve"

▼

Asbestos-Cement Pipe to Be Produced at Ambler, Pa., and St. Louis

Keasbey & Mattison Company, of Ambler, Pa., one of the oldest manufacturers of asbestos products in the United States, has recently announced that it is about to enter the asbestos-cement pipe field.

A new plant, with a floor area of 143,000 sq. ft., representing an investment of $760,000, is now under construction at Ambler for the sole manufacture of this product. The first Keasbey & Mattison pipe plant, expected to begin production early in 1938, will have a capacity of 150 tons of pipes (approximately 10 miles of the several sizes) per week. The pipe will be produced for pressures ranging from 50 to 200 lbs. per square inch.

A second plant, to be devoted to asbestos-cement pipe production, is under construction in St. Louis, where Keasbey & Mattison already has an asbestos-cement plant in operation. The St. Louis plant, to cost approximately $500,000, will have a capacity of 100 tons (approximately 7 miles) of pipe per week. Production from this plant is also scheduled for early in 1938.

Keasbey & Mattison officials, in their announcement, state that the recent evidence of a demand for such light-weight, non-corroding, non-tuberculating pipe has caused this old line company to enter the municipal water and sewage fields with asbestos-cement pipe, in addition to the industrial field.

▼

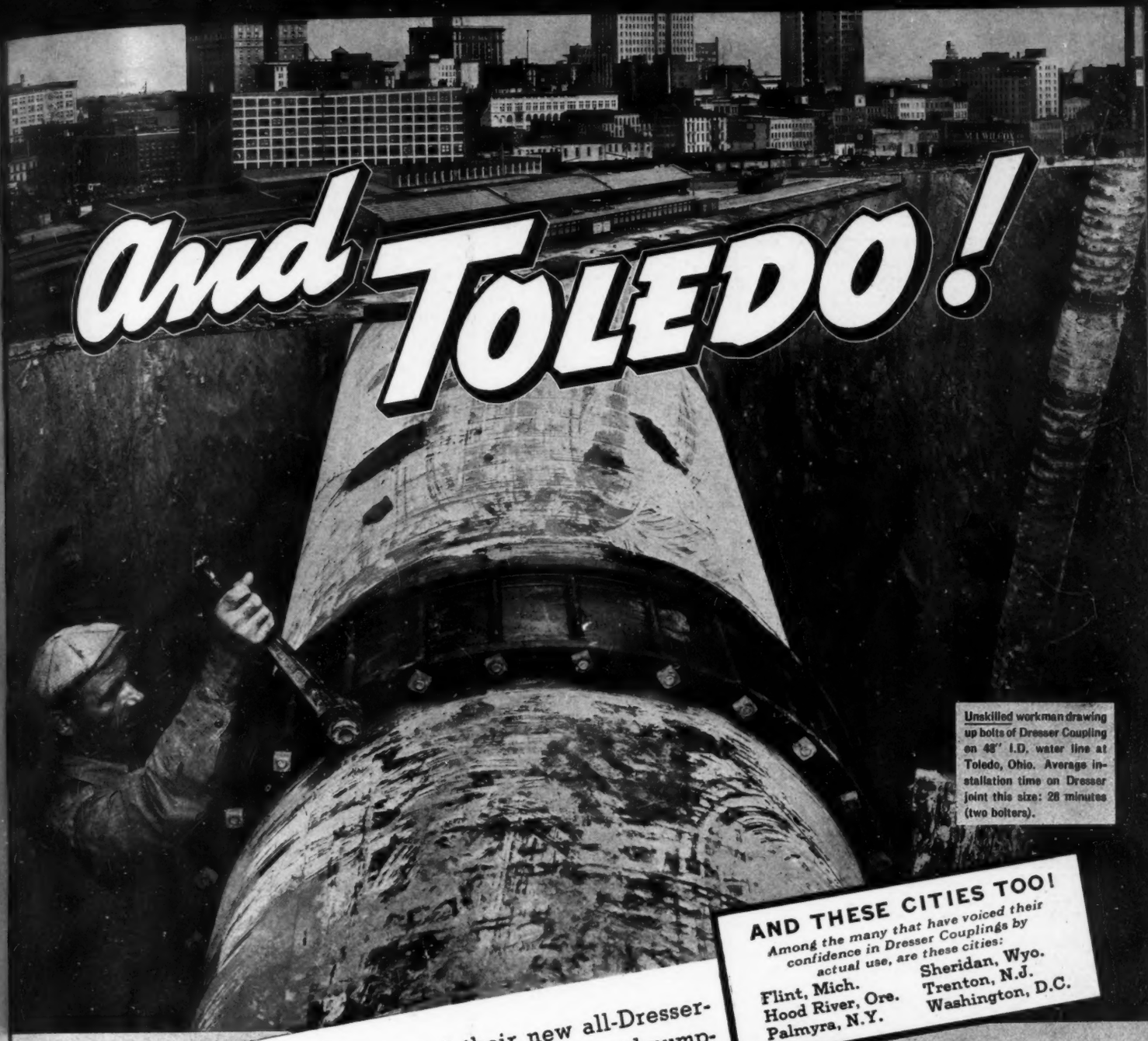
"Rite-Hite" Valve Box Top

A new top for old valve boxes is a product of Trohn's Supplies, Inc., of Mamaroneck, N. Y. Christened the "Rite-Hite," as its name signifies, these semi-steel castings are used to raise or lower old valve boxes to the right height, *without* disturbing the paving.

"Rite-Hites" are designed for use on any type valve box, and the Buffalo type cover fits them. Their application consists of inserting the adapted top (pictured) into the old box. Around the spigot end a strand yarn is tied before inserting. Cement mortar is worked into the annular space and height adjustment is secured by rotating, up or down, to position. If the old box top is below grade that is the entire operation; if above grade, the old top is broken off below grade and thereafter the procedure is the same. Paving cutting is saved and also time and labor cost of removal of old boxes.

"Rite-Hite" Valve Box Top

From outside to outside the spigot end of the "Rite-Hite" is 5 inches diameter; the bell end 8⅝ inches; the lid-seat 7⅞ inches. For folder illustrating "Rite-Hite" installations, write Trohn's Supplies, Inc., Mamaroneck, N. Y.



Unskilled workman drawing up bolts of Dresser Coupling on 48" I.D. water line at Toledo, Ohio. Average installation time on Dresser joint this size: 28 minutes (two bolters).

AND THESE CITIES TOO!

Among the many that have voiced their confidence in Dresser Couplings by actual use, are these cities:

Flint, Mich.
Hood River, Ore.
Palmyra, N.Y.
Sheridan, Wyo.
Trenton, N.J.
Washington, D.C.

After this Ohio city had completed their new all-Dresser-coupled 48" I.D. water line between filtration plant and pumping station, the engineer in charge expressed satisfaction with the "simplicity and speed of making Dresser joints," and the fact that the line could be completely backfilled *before* testing —with perfect assurance of tightness.

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. PERMANENT TIGHTNESS—proved for 50 years, on 150,000 miles of pipe.
2. FLEXIBILITY—normal pipe movements—present in every line—are absorbed.
3. SIMPLICITY—joints are "factory-made"; ordinary labor can install.
4. STRENGTH—predetermined; joints safely withstand any specified pressure.
5. TRUE ECONOMY—a truly lower joint cost throughout the life of the line.

Write for our General Catalog No. 36.

Cutaway view of Dresser Style 38 Coupling, showing working principle. Note that plain-end pipe is used. The resilient gaskets, flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

A. P. DRESSER MFG. COMPANY, BRADFORD, Pa.

CHEMICAL FEEDERS

CHLOR-O-FEEDER'S

winter quarters need

hardly be more

elaborate than a

DOG HOUSE!

The fact that Chlor-O-Feeders are not so subject to winter griefs (hence require no expensive housing!) is important when considering the *total cost* of *buying, installing,* and *maintaining* a Chlorinator.

During the past four winters Chlor-O-Feeders, housed in unheated pits, have kept operating just as long as water continued to flow through the main pipe lines.

The "Little Red Pumps"—feeding one, two, three, or more chemicals—have won hundreds of friends. New Bulletin "RED" helps to show why! Write for your copy.

PROPORTIONEERS Inc.

Associated with Builders Iron Foundry

9 N. Codding Street

PROVIDENCE, R. I.

"Bill" Flanders New Worthington-Gamon Sales Manager

Wm. C. Flanders

The Worthington-Gamon Meter Company of Harrison, New Jersey, announces the appointment of Wm. C. Flanders to the position of Sales Manager. He will succeed Geo. H. Gleeson, formerly Vice President in Charge of Sales, recently resigned.

"Bill" Flanders started with the company fifteen years ago as a salesman in New Jersey. He served the New Jersey Water Works Association as its secretary for five years; in fact, until its recent absorption by the New Jersey Section of the A.W.W.A.

▼

Weston Brothers to Carry on Gasket Business

Announcement has been received of the sudden death of Mr. L. A. Weston of Adams, Mass., on November 13th, at age of 77. Mr. Weston was the inventor and manufacturer of Weston's Gaskets and Forms for sewer pipe joints, and was actively engaged in the business up to his death.

We have recently been advised that the business will be carried on in the future by his son Lawrence O. Weston, who has served as manager of sales for the past several years, and his brother Donald Weston, who will have charge of production at the Adams plant.

▼

American Centrifuge Reorganizes

Announcement has been made of the election of Mr. Stuart Otto as president of American Centrifugal Corp., developers and manufacturers of the American Centrifuge for dewatering sewage sludges and screenings. Mr. Joseph S. Pecker, consulting mechanical engineer, who perfected the American Centrifuge for handling sludges, will continue to serve the company in a consulting and advisory capacity through the company's offices at 115 Broadway, New York City.

TRENCHER FOR SALE OR RENT

Will sell or rent on attractive terms, P&H wheel-type trencher in A-1 condition. Digs 36" trench to depth of 8'. An easy operating machine for high production. For full information address Box 534, WATER WORKS AND SEWERAGE, 400 W. Madison St., Chicago, Ill.

FOR SALE—STEEL SUPER-STRUCTURE

It is 64'6" to the top of the steel structure. The top steel I-beams are about 10' square and have cross 18" eye beams on the top platform. The legs consist of 6x6x ½" angles bolted together so as to make a cross. There are three sets of braces between the ground and top platform. Write to **Frederick G. Smith & Co., 327 E. Stephenson St., Freeport, Ill.**

COPPERAS

(FERROUS SULPHATE)

· · · FOR WATER & SEWAGE TREATMENT

(The Base For Chlorinated Copperas)

WATER TREATMENT

Summarizing the experiences with Chlorinated-Copperas in a large city another well-known and proficient manager* states in a published article* the following conclusions:

1—That it is an excellent cold water coagulant.

2—That it has reduced operating costs.

3—That it produces benefits, with no unfavorable results.

WE INVITE YOUR INQUIRIES

(References to articles and authors' names available upon request)

FAESY & BESTHOFF, INC.

22 E. 40th St. New York

WATCH

for the

Announcement

of the NEW 1938

●

EVERSON WATER STERILIZERS

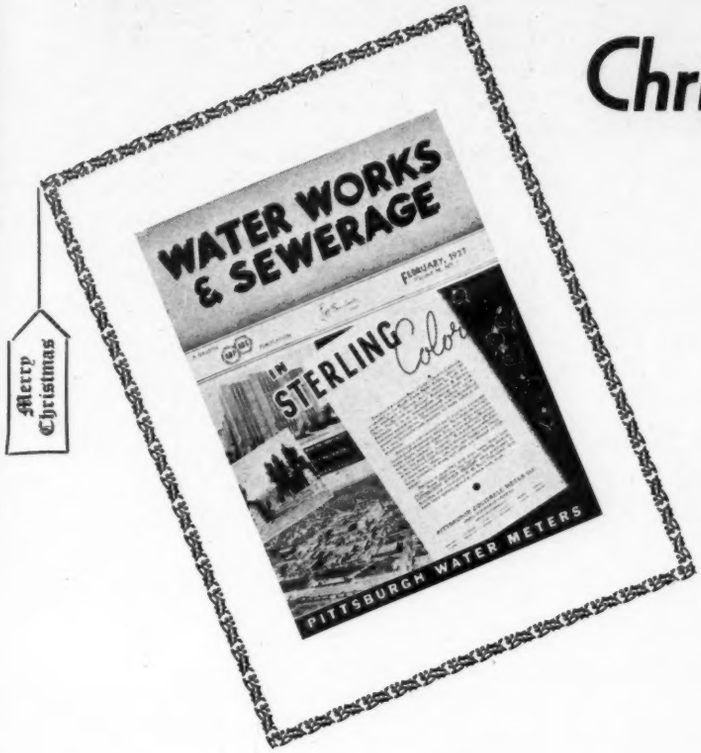
Swimming Pool—Water Works—Sewage

Advance Information on Request

●

EVERSON MFG. CO.

233 W. Huron St. Chicago, Ill.



Christmas Gift!

Some of your friends will be delighted with a year's subscription.

Fine for you, too! No shopping crowds—a bargain in price—and a pleasant reminder every month of the year of your thoughtfulness.

Just send us the names and addresses of the friends you would like to have receive the magazine as your Christmas gift. A Christmas card will be sent in your name to notify them of the gift.

Send in your order NOW—and cross from your list the names of those to whom you have decided to send this extremely valuable gift.

Special Christmas Gift Offer

2 GIFT SUBSCRIPTIONS FOR $3.00

For Each Additional Subscription Add $1.00

WATER WORKS & SEWERAGE,
400 West Madison Street,
Chicago, Illinois.

Gentlemen: I enclose $.....Please send the following gift subscriptions with an appropriate Christmas card, in my name:

Name _____ Name _____

Address _____ Address _____

Name _____ My Name (sender) _____

Address _____

Name _____ Name _____

Address _____ Address _____

KENNISON OPEN FLOW NOZZLE

Kennison Nozzle (Patented)—10-inch size.

A simple, accurate means of metering raw sewage and industrial wastes.

The Kennison Open Flow Nozzle (patented) furnishes for sewerage systems an entirely new method of measuring flow in pipes flowing partially full with wide variation in rate.

A single float serves to actuate a nearby standard Register-Indicator-Recorder. The readings can be transmitted to a distant point, if desired.

The Kennison Nozzle should be found broadly applicable to the numerous flow metering problems under low heads in main systems and in the disposal plant.

Write for new descriptive Bulletin 289 which gives detailed dimensions and capacities.

Laboratory Calibration Test of Kennison Nozzle

BUILDERS IRON FOUNDRY

"Builders of the Venturi Since 1891"

9 Codding St. Providence, R. I.

MEETINGS SCHEDULED:

Dec. 29—NEW YORK CITY, N. Y. (Hotel New Yorker).
New York Section & New Jersey Section A.W.W.A. Joint "Get-Together" Luncheon, followed by meeting. Sec'y., N. Y., Section, R. K. Blanchard, 50 West 50th St., New York City. Sec'y., N. J. Section, H. N. Lendall, Rutgers University, New Brunswick, N. J.

Jan. 17-21—STILLWATER, OKLA. (A. & M. College).
Oklahoma Water & Sewage Conference. Water & Sewage Short Course. Sec'y. of Conference, J. H. Darcey, State Dept. Health, Oklahoma City. Head of Short Course, Prof. E. R. Stapley, A. & M. College, Stillwater, Okla.

Jan. 19-21—NEW YORK CITY (Engineering Societies Bldg.).
American Society of Civil Engineers. Sec'y., Geo. T. Seabury, 33 West 39th St., New York City.

Jan. 20*—BOSTON, MASS. (Statler Hotel).
New England Water Works Assn. (Monthly Meeting.) Sec'y., Frank J. Gifford, 613 Statler Bldg., Boston, Mass. *(Other scheduled meetings Feb'y. 17th and March 17.)

Jan. 20-22—NEW YORK CITY (Hotel McAlpin).
New York State Sewage Works Assn. (Annual Meeting.) Sec'y., A. S. Bedell, State Dept. Health, Albany, N. Y.

Feb. 14-19—COLLEGE STATION, TEX. (A. & M. College).
Texas Water Works Short School. Sec'y., V. M. Ehlers, State Dept. Health, Austin, Texas.

Feb. (date open)—NEW BRUNSWICK, N. J. (Rutgers University).
New Jersey Section A.W.W.A. Sec'y., H. N. Lendall, Rutgers University, New Brunswick, N. J.

Mar. 17-18—JAMESTOWN, N. Y. (Hotel Jamestown).
New York Section A.W.W.A. Sec'y., R. K. Blanchard, 50 West 50th St., New York City.

Mar. 21-23—LOUISVILLE, KY. (Hotel not announced).
Kentucky-Tenn. Section A.W.W.A. Sec'y., H. D. Schmidt, State Dept. Health, Nashville, Tenn.

Mar. 23-25—WINDSOR, ONTARIO (Prince Edward Hotel).
Canadian Section A.W.W.A. (Annual Meeting.) Sec'y.-Treas., A. E. Berry, Ontario Dept. Health, Parliament Bldgs., Toronto, Ont.

Apr. 5-6—(Place not announced).
Illinois Section A.W.W.A. Sec'y., Mr. Winfred D. Gerber, P. O. Box 232, Urbana, Ill.

Apr. 7-8—LAFAYETTE, IND. (Purdue University).
Indiana Section A.W.W.A. (Annual Meeting.) Sec'y.-Treas., John A. Bruhn, Indianapolis Water Co., 113 Monument Circle, Indianapolis, Ind.

Apr. (date open)—(Place not announced).
Kansas Water and Sewage Works Assn. Sec'y.-Treas., Ernest Boyce, State Board of Health, Lawrence, Kan.

Apr. 24-28—NEW ORLEANS, LA. (Hotel Roosevelt).
American Water Works Association. (Annual Convention.) Executive-Secretary, H. E. Jordan, 29 West 39th St., New York City, N. Y.

May 13-14—BOZEMAN, MONTANA (Baxter Hotel).
Montana Section A.W.W.A. Sec'y., H. B. Foote, State Board of Health, Helena, Mont.

May 19-21—SPOKANE, WASH. (Hotel not announced).
Pacific Northwest Section A.W.W.A. Sec'y., Fred Merryfield, Oregon State College, Corvallis, Ore.

May 23-25—DAYTONA BEACH, FLA. (Hotel not announced).
Florida Section A.W.W.A. Sec'y., J. R. Hoy, 404 Hildebrant Bldg., Jacksonville, Fla.

CATALOGS AND LITERATURE RECEIVED

[*Any of the publications rewiewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.*]

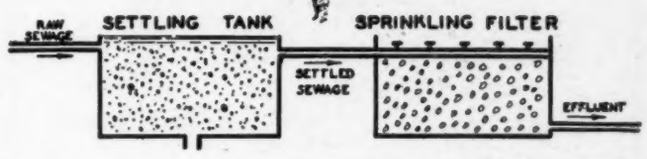
"Homelite Portable Pumps and Blowers"—Are illustrated and described in a new 4-page bulletin, prepared in easy to digest style, by the Homelite Corp. of Port Chester, N. Y. It is picturized to show at close

view the several utilitarian and easily portable Homelite units; and, at distant view, the several jobs being serviced by compact Homelite gasoline engine driven blowers, pumps, compressors, generators, flood lights. The brief descriptive matter opposite each picture completes a story for quick reading. This master folder is supplemented by more detailed facts in separate bulletins covering each unit, for mailing upon request. The adaptability of these handy one-man "Tool-Box" type units, having multiple uses, will prove as interesting to sewerage operators as they have to water works operators and contractors. For a copy of "Homelite Portables" write Homelite Corp., 179 Riverdale Ave., Port Chester, N. Y.

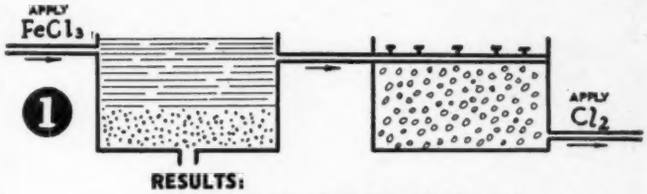
"Economy in Water Transportation"—Is the theme of a new, enlightening and useful 32-page Johns-Manville Transite Pipe bulletin—the most complete yet issued on this product. It introduces the reader to 24-year-old cement-asbestos pipe, as having first been produced for successfully transporting corrosive sea water, and now manufactured in 20 plants, accounting for the 23,000 miles of this lightweight non-tuberculating product in service. A meaty section deals with the comparative water carrying capacities and friction losses (predicted and actual, old and new) of ferruginous and cement base pipes, as supported by records, quoted portions of committee reports, and excerpts from actual reports of tests made by the Pitometer Company and other investigators. What increased and sustained capacity means (1) in economy of installation (pipe size reductions), and (2) continuing savings in operating costs (pumping) are set forth and illustrated by illuminating charts, useful to engineers and operators alike. A chapter is devoted to pipe line maintenance stresses freedom from electrolysis troubles, pitting (inside and out), repairs, periodic cleanings. The advantages of the rubber gasketed flexible joints (couplings) employed enumerate leak tightness, flexibility, laying curved lines with straight pipe, ease and economy of assembly. Methods and ease of tapping, and pipe cutting (with a common carpenters' saw), insertion of fittings, tamping and backfilling, are described and illustrated. Then is described the care and precision in Transite Pipe manufacture and testing, which is followed by excerpts from the reports of the Underwriters Laboratories, which has approved Class B Transite Pipe for fire protection lines. Then many pictures of representative installations and opinions from users appear. Finally are presented specifications covering Transite Pipe and its laying, accompanied by weight and dimension tables covering various classes of pipe and the Simplex couplings. Presented, also, are eight comparative advantages of Transite pipe in sewer construction. For a copy of "Transite Pressure Pipe," write Johns-Manville Corp., 22 East 40th St., New York City.

"Flexible Drive Shafts"—In a recent symposium on "Pumps and Pumping," in the water and sewage field, held under the auspices of the American Soc. of Mechanical Engrs., considerable interest developed amongst engineers in the modern adaptation of flexible drive shafts for pumps, the shaft being equipped with unique universal-joints serving as do those used on motor-truck drive shafts. From pump manufacturers came considerable favorable comment on the development. In a recent mail has been received a bulletin from H. S. Watson Co. of San Francisco, illustrating and describing Watson-Spicer Flexible Drive Shafts for driving vertical or horizontal pumps; also gear-driven deep well pumps. Interesting is the adaptation of the floating-end tubular shaft, and the unique W.-S. "Needle Bearing" Universal Joints. A cut-away section clearly pictures and describes each feature of the floating end

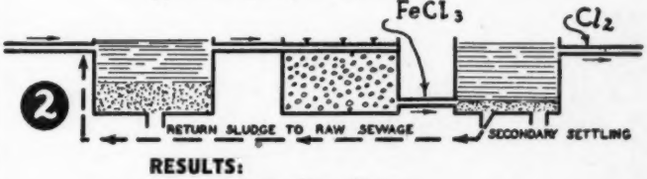
CHEMICAL TREATMENT COULD HELP THIS MUNICIPAL SEWAGE PLANT



This simple flowsheet is taken from an actual municipal sewage treatment plant operating in a small California community. Some dairy wastes are added to the domestic sewage. The plant does a fair job, but it gives off objectionable odors and it does not give a clear effluent. Here are two ways that chemical treatment could help this plant:



RESULTS:
(a) Great reduction in B. O. D. (biochemical oxygen demand) of settled sewage going to sprinkling filter.
(b) Odor reduction at entrance to plant.
(c) Filter capacity increased.



RESULTS:
(a) Much clearer filter effluent.
(b) Odor nuisance greatly reduced.
(c) B. O. D. load on filter greatly reduced.
(d) Overall efficiency greatly increased.

Can chemical treatment help your plant?

Yes—chemical treatment with Ferric Chloride can help any sewage plant consisting of at least a settling tank. If you have more extensive treatment, Ferric Chloride can help you obtain more economical operation. You may not need any additional equipment except an inexpensive applicator. Send us details of your present treatment and we will gladly supply details without obligation.

Liquid Chlorine • Ammonia • Ferric Chloride

GREAT WESTERN ELECTRO-CHEMICAL CO.

9 MAIN STREET, SAN FRANCISCO
PLANT: PITTSBURG, CALIFORNIA
4151 BANDINI BLVD., LOS ANGELES

BORN 35 YEARS TOO SOON

Many a business leader of today applied his back muscles to obtain the family's supply of water from the old wooden pump. But most of the next generation will be unable to boast of the pump handle as a muscle builder.

Today, modern water purification plants, in charge of competent chemists and engineers, are fast replacing outmoded and often dangerous water supplies of past generations.

Health authorities everywhere have long since recognized the tremendous importance of water chlorination as a means of wide-spread elimination of diseases. The modern water plant is standard equipment in communities almost everywhere.

But state and municipal water-works plants must be insured of *quick* and *adequate* supplies of Liquid Chlorine —and advice and technical assistance when they need it! Solvay's "Big 3" Service is a service system upon which water-works men can always depend.

Solvay Liquid Chlorine shipments are now routed from Syracuse, New York and Hopewell, Virginia. Upon announcement early in 1938, shipments will also be made from Baton Rouge, Louisiana. Your inquiries on Solvay Liquid Chlorine are cordially solicited. Please write to the nearest branch office listed below.

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 RECTOR STREET **NEW YORK**

BRANCH SALES OFFICES:

Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Indianapolis, Kansas City, New Orleans, New York, Philadelphia, Pittsburgh, St. Louis, Syracuse

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LIQUID CHLORINE

and "Needle (Roller) Bearings," within sealed lubricant chambers. Revolutionary, in pump drive, is the illustrated claim that each joint will absorb angular misalignments up to 20 degrees each side of the center-line. Specifications in tabulated form (with illustrations) cover a variety of types and shaft sizes, of 1 to 250 H.P. capacity. So well proven is the new flexible drive that the bulletin lists 10 leading pump manufacturers who approve and supply the Watson-Spicer Drive, when specified, or where indicated to insure high reliability. Doubly interesting is the fact that the "Needle Bearing" joints are competitive in cost with commonplace shaft couplings. Aside from pump drive, these novel flexible floating-end shafts should be of interest wherever drive shafting is employed in modern water and sewage plants, with their variety of mechanical equipment. The "W.-S." bulletin might have been captioned "Whipping the Whip" (and the bearing and alignment) problem in drive shafting. Every engineer and manufacturer should find the Watson-Spicer brochure worth writing for. Ask for Bul. No. 5, H. S. Watson Co., 1145 Harrison St., San Francisco, California.

"Mathieson Chemicals"—Is the caption of an attractive booklet from Mathieson Alkali Works, old and important chemical producers, with three major plants spread from Niagara Falls and Saltville, Va., to its newest at Lake Charles, La. Interesting Mathieson history reveals that the first American production of gaseous electrolytic chlorine and caustic soda, in Mathieson's unique Castner rocking cells, took place in its Saltville, Va., works in 1895 and, on commercial scale, at Niagara Falls a year later. At that time all chlorine went into chlorinated lime, commonly known as bleaching powder. More pioneering is evidenced in Mathieson's development of the money saving one-ton chlorine container and its multiple unit tank car, since released for use by all chlorine manufacturers. Likewise, a pioneer (1923) in production of anhydrous ammonia from electrolytic hydrogen and atmospheric nitrogen. And, from some of the latest pioneering (1928) has come Mathieson's super-hypochlorite (H.T.H.) in dry powder form containing more than twice the chlorine content of the older chlorinated lime product—bleaching powder. Then came Mathieson "Dry Ice," now far beyond the novelty stage. With attractive picturization, "Mathieson Chemicals" describes the 17 distinctive products manufactured; lists them in tabular form to show where, and how, each chemical is used by industry and in the municipal field. A spot map shows locations of Mathieson plants. For "Mathieson Chemicals," which is something more than a sales talk, write Mathieson Alkali Works, Inc., 60 East 42nd St., New York City.

"Pipe Thawing Manual—by Hobart"—A timely and useful manual on pipe thawing has come from Hobart Brothers, manufacturers of electric welding machines in a variety of styles and capacities. It sets forth valuable "Hints for Successful Pipe Thawing," based on experiences in Chicago and elsewhere. "Field Experiences" with Hobart's Simplified (low voltage) Welders are presented, and sketches indicate typical methods of connecting and operating electric welders in pipe thawing, under a variety of conditions. Typical costs are given for the cases illustrated. Every water works operator threatened with the possibility of cold weather troubles will find the "Hobart Pipe Thawing Manual" worth studying and preserving for ready reference thereafter. For a copy, write Hobart Bros., Dept. WS, Troy, Ohio. [Unexplainable is the fact that the location of the

Hobart factory, or distribution points, is nowhere to be found in the "Manual."—Ed.]

"Olympic Bronze"—Is the caption of a recent 48-page bulletin by Chase Brass and Copper Co., which describes and illustrates the properties and methods of fabricating the hard and corrosive resisting Olympic Bronze—an alloy of copper and silica. Its tensile strength, hardness, toughness, and other physical and chemical qualities are set forth. Considerable space and detailed (illustrated) suggestions are given in respect to methods of arc and flame welding the bronze alloy. Then follows a section of pictures of applications, including those in water and sewage systems and treatment plants, where strength and durability are prerequisites. At the end are several tables of weights and thickness of sheets, pipe, tubes, rods and wire. For the new bulletin, "Olympic Bronze," descriptive of the material and suggestive of adaptations, write Chase Brass and Copper Co., Waterbury, Conn.

"Acid-Proof Cements—by Quigley"—A fairly new product of the Quigley Company, New York City, is described in a new bulletin covering their Acid-Proof Cements for use in lining acid tanks, laying up tiile work or brick, in tank and sewer construction where acid attack from industrial sewages or sewer gas is apt to occur. The Quigley Cements are suggested for jointing, pointing-up, and other uses around water and sewage plants, including building of ferric chlorine towers from glazed sewer pipes, and stacks for sludge gas boilers, in which sulphur fumes are oxidized to acid. One picture illustrates a large brick sewer on which 150 tons of Acid-Proof Cement were used. Specifications given cover the black and gray. Also Quigley Acid-Proof Brick are described along with other Quigley products. For a copy of Bul. A P 122-R, write Quigley Company, Inc., 56 West 45th St., New York City.

"Armco Paved Invert Pipe"—Is presented in a uniquely arranged booklet issued by the Armco Culvert Mfgrs. Association. It recounts the highlights of the history behind 41-year-old corrugated drainage pipe, through its development to modern day Asbestos Bonded Armco Pipe in diameters 6 to 96 inches. It pictures growing usage, durability and dependability of the product, in more recent years employed on sanitary and combined sewers as well as drainage projects. For descriptive literature on "Asbestos Bonded Armco Pipe" write Armco Culvert Mfgrs. Assn., Middletown, Ohio.

"Non-Clog Pumps—by Yeomans"—Are covered in a recent bulletin from Yeomans Brothers Co. of Chicago, describing their new Type "HNC" horizontal non-clog sewage and sludge pumps to handle 50 to 10,000 G.P.M. flows up to a head of 100 ft. Featured are "Yeomalite" treated impellers, to preclude grit wear and corrosion; exclusive two sealed Timken tapered roller bearings, in split housing, easily renewed wearing parts. An impressive list of Yeomans Bros. sewage pump installations and a picture of a battery of the newest pumps complete Bulletin 6220. Address, Yeomans Brothers Co., 1433 Dayton St., Chicago, Ill.

"Running Water"—Is the theme of a new FORD pocket-sized brochure that warns operators, *"Don't Let Running Water Run Away with You."* It's a snappily gotten up booklet with entertaining sketches (cartoons) on each page, of perplexed or happy operators, as the case may be. Below each is the dignified picturization of the Ford Unit needed to correct "What's Wrong with This (and That) Picture?" It makes enjoyable and instructive reading, should result in sales to "you fellers in the same dern fix." If you haven't seen it, get a copy of "Running Water" from The Ford Meter Box Co., Wabash, Ind.

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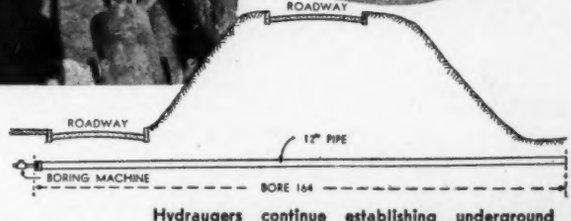

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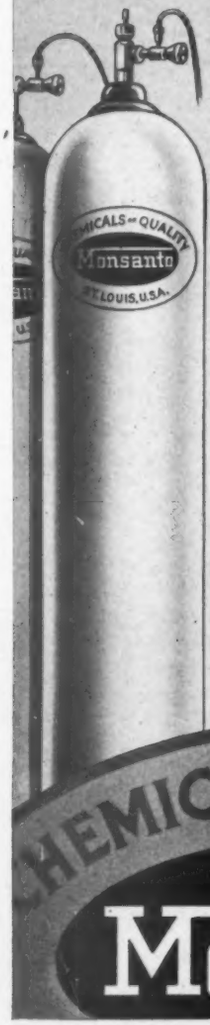

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* * *

"What ails our water pressure, Joe?" says the Mayor to the Water Commissioner. "Pressure's okay at the pumping station," retorts the Water Commissioner. "Trouble is the water is hard—chokes household water heaters and piping with scale. As I've told you before, we need a Permutit municipal water softener."

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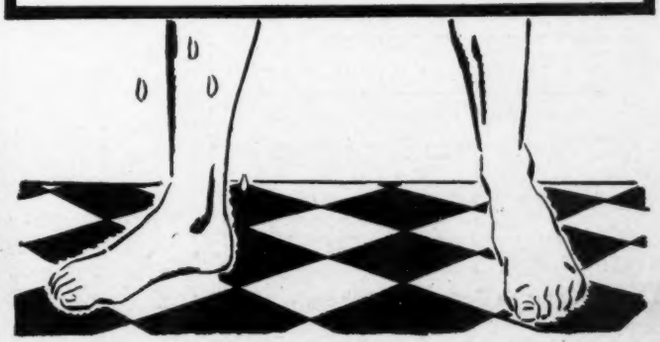

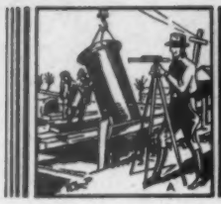

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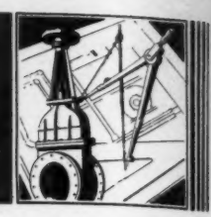

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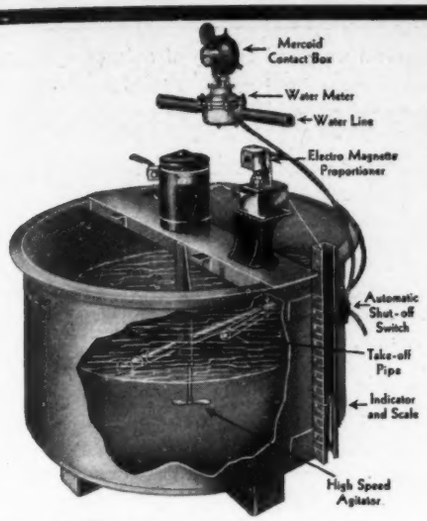

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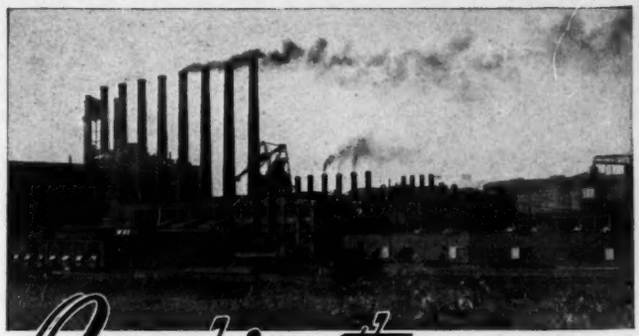

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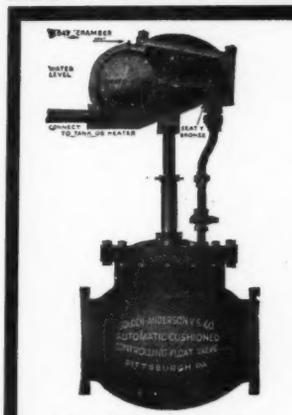

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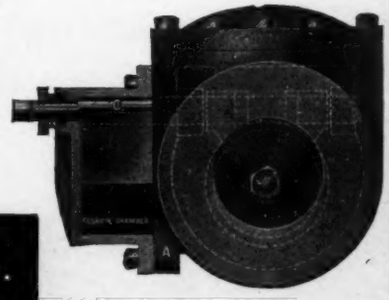

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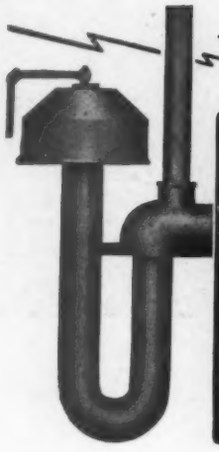

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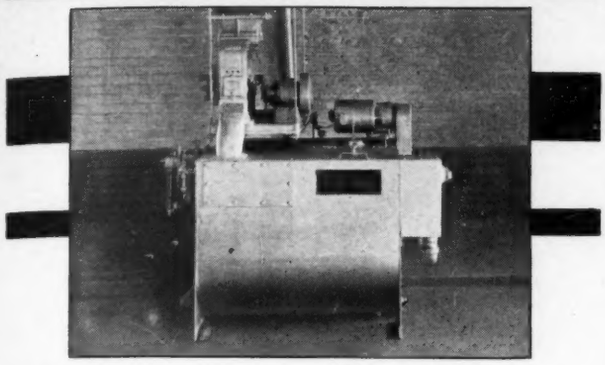

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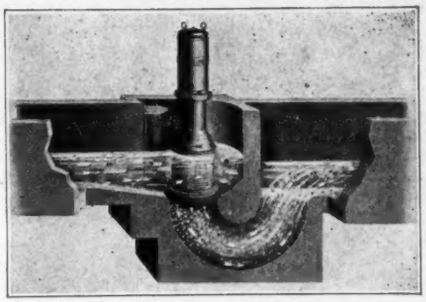

Fig. 2202—Comminutor installed and operating. Screening and screenings disposal are eliminated. Coarse sewage matter is cut into small settleable solids without removal from channel.

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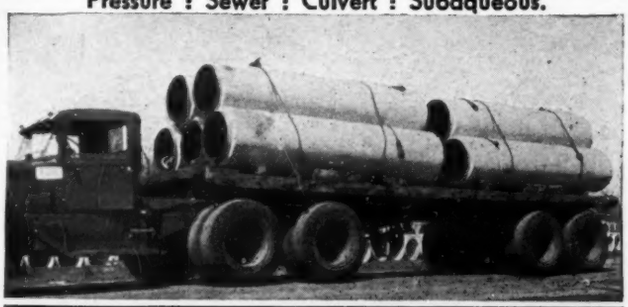

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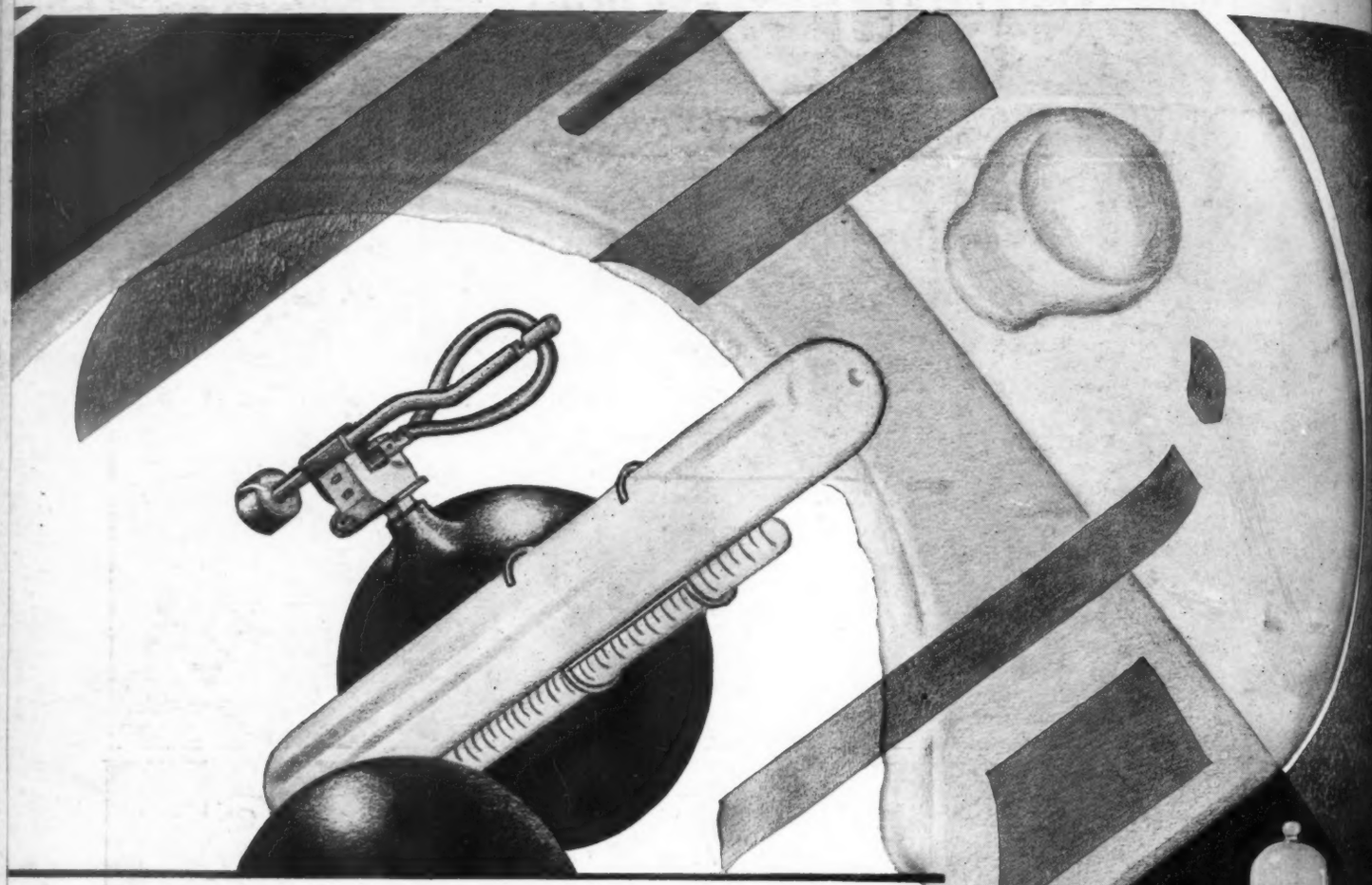

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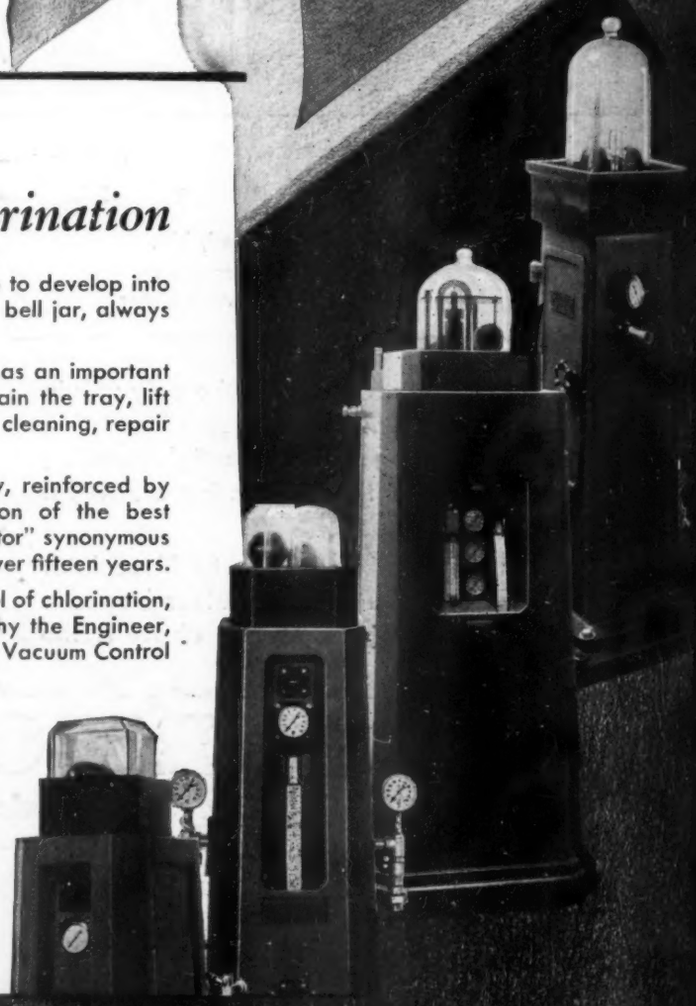

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